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CHINA REPORT

SCIENCE AND TECHNOLOGY

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NATIONAL DEFENSE INDUSTRY REVITALIZATION MEASURES DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHI GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 10, 12 Oct 86 pp 33-35

[Article by Liu Xinyi [0491 1800 0001] of Institute No 611 of the Ministry of Aeronautics: "Preliminary Discussion of Reform Measures To Revitalize the National Defense Science and Technology Industry"; edited by Wan Li [8001 0500]]

[Text] National defense science and technology industry is not only the base of military production, but also the forerunner of civilian production and, more important still, a great asset in China's economic development. This asset is manifested mainly in the broad scope, the complete range of support projects, the superior equipment, the strong technical force, and the tightly controlled branches of the military industry; the competence and great innovative capacity of the leading bodies and the workers and staff members of the military industrial branches; and the great potential, strong reserve force, and abundant fixed assets of the military industrial enterprises and establishments. One of the new tasks which will confront us is to develop this superiority of the military industry system, to mobilize the initiative and creativity of its workers and staff members, to accelerate the combination of military and civilian industries in the reform, and to revitalize the national defense science and technology industry.

There are many ways to revitalize the national defense science and technology industry, and many enterprises and establishment engaged in military and civilian industries have made great efforts in this direction with notable success. A tentative discussion of these ways from the standpoints of the overall situation, policies, and external factors is presented as follows:

I. Enhance Understanding, Accomplish a Conceptual Shift

Without a conceptual shift, the reform will become empty talk. On the central issue of restructuring the economy and science and technology, the first conceptual shift to be accomplished in the national defense science and technology industry is from the concept of single military production to that of combined military and civilian production, from the concept of self-imposed blockade to an open type, and from the concept of scientific research in production to one of exploitation and business operations. The most important

condition is for the existing enterprises engaged in military industry to be changed into those of a combined military and civilian production mode. The so-called combined military civilian production, as a concept, does not mean the engagement of military industries in civilian production at all. The enterprises of a combined military and civilian production type touches on the question of system and the question of the their characteristics. These enterprises are neither military nor civilian in character. Their functions and characteristics determine their engagement in both military and civilian production, although the ratio between military and civilian products may vary in different periods.

What are the qualifications of an enterprise of the combined military and civilian production type? These qualifications can generally be summarized under the following five categories. First, its service should be oriented to both national defense and various sectors of the national economy, with, however, priority for military production. Second, its product mix should be changed from one of solely military production to one of economic diversification. It should produce some highly competitive major civilian products, so that whenever there is little or no assignment for military production, it can rely on civilian production as a means of support and a source of profits to be delivered to the state. Third, the structure of enterprise should be changed from one of a closed type that is "large and complete" or "small and complete" to one of cooperative specialization with the development of horizontal economic relations. Fourth, in developing new products, it should produce advanced and fine-quality products that are in demand on the domestic and foreign markets instead of producing ordinary civilian products. In administration, the enterprise should engage in both production and business operations instead of solely engaging in production, and set up systems of developing new products, technical training, market information and forecast, sales, and maintenance service.

II. Accelerate the Reform, Take Further Steps in the Delegation of Power and the Retention of Profits

At present, the reform of national defense science and technology industry is basically oriented to a change in the relationship of ordering goods, to step by step experiments in the contract system and the system of responsibility for revenues and expenditures, and to further consolidation of the system of factory directors (or managers) or institute directors (or presidents) assuming full responsibility--all according to the requirements of developing a planned commodity economy and the commercialization of technical achievements, and centering on a reform of the system of fund allocation. To accelerate the reform, we should also help the enterprises overcome their difficulties, increase their vitality, adopt the system of profit sharing, increase the enterprises' share of depreciation funds, and support their wage reform. At the same time, we should support the enterprises at the lower levels and help in their integration of different forms. To increase civilian exports, we should also work out different proportions of foreign exchange retention for different export products, enforce the policy of rewards for exports and the policy of preferential treatment of loans, and adopt an agency system for civilian products in our foreign trade.

III. Extend Loans and Subsidize Interest Payments, Raise Funds through Different Channels

We must raise more funds to accelerate the commercialization of technical achievements and to build production lines for civilian goods. First, the enterprises themselves should tap their own potential and use their own funds judiciously in order to reduce the input and increase the output. Second, they should be encouraged to obtain bank loans, while the departments in charge should subsidize or partly subsidize their interest payments. For example, if the People's Bank of China grant loans for the use of military industrial technology in the development of civilian projects for 3 years or less, the interest rate will be 4.2 percent; for 4 years, 4.8 percent; and for 5 years, 5.4 percent. If the interest payments are also subsidized, or partly subsidized by the departments in charge, we will be able to accelerate the shift of military industry to civilian production.

IV. Reduce Mandatory Plans, Increase Guiding Plans

To increase the decisionmaking power for the enterprises, we should reduce the scope of mandatory plans and gradually enlarge that of guiding plans. All mandatory plans should be examined and passed down to the lower levels by the departments in charge in a unified way. The enterprises have the power to decide on all guiding plans according to market demand and without the intervention or examination of the departments in charge, in which case, as a matter of principle, the enterprises should acquire their own raw materials and sell their own products. The prices, also as a matter of principle, will be uniformly set by the state according to the quality. In the absence of any uniformly price, however, the enterprises can set their own prices within the limits prescribed by relevant state regulations and policies.

The measures and channels to revitalize the national defense science and technology industry, based on an analysis of the internal factors, are as follows:

I. Step Up the Readjustment of National Defense Science and Technology Industry

Readjustment in this case provides the key to success in "military-civilian combination" and "protecting military industry in its shift to civilian production." At present, we must pay special attention to the following: First, readjustment of the product mix of military-civilian production. To resolve the contradiction of a large set-up with little assignment, we must be able to maintain a small but highly competent force to engage in scientific research for military production, and condense the scientific research and production line for military goods. At the same time, we must selectively organize production lines for civilian goods according to the planned scale, and organize the readjustment of the structure and technical force. Second, readjustment of the structure of government departments. Reform must be carried out in accordance with the requirements of "synthesis above, separate entities below" and "protecting military industry in its shift to civilian production," while the work of market forecast and developing products, sales, and post-sale service, in particular, must be strengthened. Third,

readjustment of funds. Based on the present funding arrangements, we must spend within the limit of our income and leave some credit balance; refrain from striving for high standards and making ambitious plans that are unrealistic; and stress the need for a unity of input and benefits. Fourth, readjustment of technical transformation. Based on the plans for developing civilian goods, we must selectively build production lines and ensure good quality and increased output. Economic appraisal must be strengthened on the technical transformation projects, and the procedures of examination and approval must be improved. Fifth, readjustment in the control of decentralization. In either military or civilian production, we must know the direction of our main attack, and concentrate our resources to make a breakthrough at the key point. We must oppose low-standard duplication, decentralization, chaos, and backwardness, besides strengthening unified management and upholding macrocontrol. As a matter of principle, we must readjust the control of decentralization to protect military industry and to form integrations of localities to promote civilian production.

II. Actively Develop Products

The development of military goods depends on mandatory plans, while the key to the development of new civilian goods lies in the correct selection of their models so that they can be easily sold on the market. All products that are easily marketable and can yield good economic results, should be actively developed, and all legitimate methods of creating wealth should be adopted. The long-range plans should be combined with the short-range plans, and the production of competitive products should be combined with that of minor products. The potential and productive capacity and technical equipment should be fully used to develop new products for better economic results.

To develop new products, we must first set up production lines for the major products. Second, in accordance with the principle of making a good start and achieving specialization, large batch production, and good economic results, we must perseveringly combine independent development and active creation with the assimilation of imported technology which must be quickly turned into Chinese technology. Third, for those products which have already gained a firm foothold in China and have been rewarded for their fine quality at the national, provincial, or ministerial level, we should create the conditions for their export in order to earn more foreign exchange. Fourth, we must fully mobilize the initiative of both the departments in charge and the enterprises or establishments. The main job for the departments in charge is to unclog the channels, to include the development of new products in the plans of different trades, and to support the enterprises in the large-scale development of major products, while the enterprises themselves must use their own initiative in developing new products in large amounts by taking the road of joint development by the localities. The enterprises can also raise their own funds, pool their resources, or find their own way to utilize foreign funds.

III. Develop Integration in Various Forms, Accelerate the Shift of Military Industrial Technology and Achievements

The development of new products through local integration can generally take three forms. The first is to use central cities as the base and the general assembly enterprise or key enterprise as the "leading factory of a chain" of local enterprises to form local integrations of various types. This is the main form for large-scale batch production. The second is integration of a specialized nature. To take advantage of the superior productive capacity of the technology and equipment of the military industry system, multiregional integration of the enterprises of the same specialty in the same system, or of the units producing the different parts or accessories for the same products can be formed. The third is integration of units in the same trade throughout the country formed to provide mutually supportive services. All forms of integration can be loosely and tightly organized, or organized for the combined purpose of production, supply, and marketing. A board of directors or the "leading factory of a chain" will be responsible for the coordination of programs, plans, support, production technology, pricing, and post-sale service. The integration should be in line with the principle of voluntary participation, equality, and mutual benefits, and attention should be paid to economic results.

To further promote the shift of military industrial technology and achievements, we must first adopt the method of "going out and inviting in" to enhance the effects of military industry. We must pay attention to the survey of the technical commodity market "without being tired of the trouble, the meager amount, or the complexity involved." The transfer of technology must be compensated, the cooperation and coordination between the first and the third line regions must be strengthened, and horizontal economic integration must be developed. Second, we must strongly support the development of the township and town enterprises. Third, in order to popularize the transfer of military industrial technology in an organized and planned way and to accelerate the transfer, we should set up consultation service systems at all levels, and these systems will form a network with its axis reaching Beijing at the top, joining the provinces and regions at the middle, and coming down to the enterprises and establishments below.

IV. Put the Improvement of Quality and the Promotion of Modernized Enterprise Management in a Very Prominent Position

In both military and civilian production, we must firmly adhere to the "quality first" principle. To improve the quality of products and to ensure the attainment of this goal, we must first correctly handle the dialectical relationships between quality and quantity, and between quality, economic results, and speed. There must be good quality before we may consider quantity, economic results, and speed. We must realize that the technical force of enterprises are now in the stage of a large-scale replacement of the old by the new personnel, and that is why attention to quality is particularly necessary and important. Premature moves may bring endless harm. Therefore, we must resolutely oppose the practice of being greedy for profits and giving no thought to the consequences, and thoroughly correct the erroneous idea of ignoring quality and the social and economic results. Second, we must step up

total quality control and perfect the economic responsibility system and various management systems with quality improvement as the central task, and quality tests must be conducted at all levels. Third, the contingent for examining quality must be strengthened and perfected. We must also keep it relatively stable, strengthen its technical training, and solve its real problems.

The main way to improve the economic results during the Seventh 5-Year Plan is to promote modernized enterprise management and reduce material consumption. We must also start with basic control which we will continue to escalate, so that the various controls in the enterprise and establishment will be strengthened, improved, and coordinated for their continued development in a systematic, standardized, and highly scientific way. In the course of scientific research for military and civilian production and the trial manufacture of new products, we should extensively use the methods of PERT and of management by policy and objective, combine control of the production process with the management of enterprises, and gradually set up a fairly complete system of information collection, processing, and forecasting. At the same time, we must carefully control the consumption, raise the proportion of finished products, and try our best to lower the cost. We should also conserve energy, develop resources and curtail consumption, and improve the economic results in every possible way.

V. Ensure That Efforts Are Made To Build a Society That Is Advanced Both Materially and Culturally and Ideologically

To ensure that efforts are made to build a society that is advanced both materially and culturally and ideologically is an important strategic policy of the Party Central Committee for building socialism with Chinese characteristics. To revitalize the enterprises and units in the national defense science and technology industry, we must, first, correctly handle the relationships among three parties, namely, the factory director (or manager), or the institute director (or president), the party committee, and the workers congress. Second, ideological and political work must be carried out throughout at every link of the entire process including planning management, fund management, material management, technology management, labor personnel management, and the management of logistics in administration. Third, great efforts must be made to build a contingent of cadres who are keenly dedicated to work, have the quality of leadership in organization and management, and meet the requirements of being "young, revolutionary, well educated, and professionally competent"; and a work force having high ideals, integrity, good education, a sense of discipline, and a concept of the legal system which can pass stiff tests. After all, we must be able to "ensure that efforts are made to build a society that is advanced both materially and culturally and ideologically, undertake both tasks simultaneously, bear the two responsibilities at the same time, and reap the fruits from both at once."

9411
CSO: 4008/2013

STATE ECONOMIC, S&T COOPERATIVE PROJECTS ANNOUNCED

Beijing GUANGMING RIBAO in Chinese 5 Sep 86 p 1

[Report by Wang Lin [3769 2651] and Wu Yali [0702 7161 7787]: "The State Defines 200 Economic S&T Cooperative Projects"]

[Text] Two hundred research projects jointly participated in and developed by 100 medium to large enterprises, 38 institutes, and 37 higher institutions were recently included by the State Economics Commission, the State Education Commission, and the Chinese Academy of Sciences in the first group of national major projects concerned with economic, and scientific and technical cooperation. All three expect that with the cooperative guidance for these projects, a path regarding the lateral associations of production, science research, and colleges and institutions will be uncovered that is suited to our national situation. On 3 September, a contract signing ceremony was held for 10 projects in Harbin.

For some time now, the situation has been serious regarding the separation between research organizations and enterprises, the fragmentation of research, design, education, and production, and the distances between the civilian and military, between departments, and between regions. According to statistics, there are 4,700 major research organizations in this country that are separate from enterprises, unique in all the world. Equipment in these research organizations is advanced, there is an abundance of capable people, and in the past all has depended upon funding from the state for maintenance. At the same time, there are approximately 400,000 enterprises within the state budget. There is a lack of scientists and technicians within these enterprises, equipment is seriously obsolete, the levels of production technology are not high, and the quality of many products is not acceptable. On the one hand, research organizations have suppressed large amounts of science research achievements from being disseminated, while on the other hand, enterprises urgently need advanced technology to improve their levels of production. For these reasons, the enhancement of lateral associations among scientific and technical circles, education circles, and enterprise circles, and the strengthening of enterprises, and especially the capacity for technology development of medium to large key enterprises, are problems that are currently very acute. The 200 major economic, and scientific and technical cooperative projects are primarily distributed among the fundamental industries of raw materials, machinery and electronics, energy, and light

industry and textiles. These projects are intimately related to the economic goals that are the absorption and assimilation of enterprise imported technology, indigenization, generation of exchange through exports, high quality and low energy consumption, and major technology transformations, and will have a decisive part in the economic development of industries or regions. It is understood that the state will implement certain economically preferential policies for these major cooperative projects.

12586
CSO: 4008/2006

NATIONAL DEVELOPMENTS

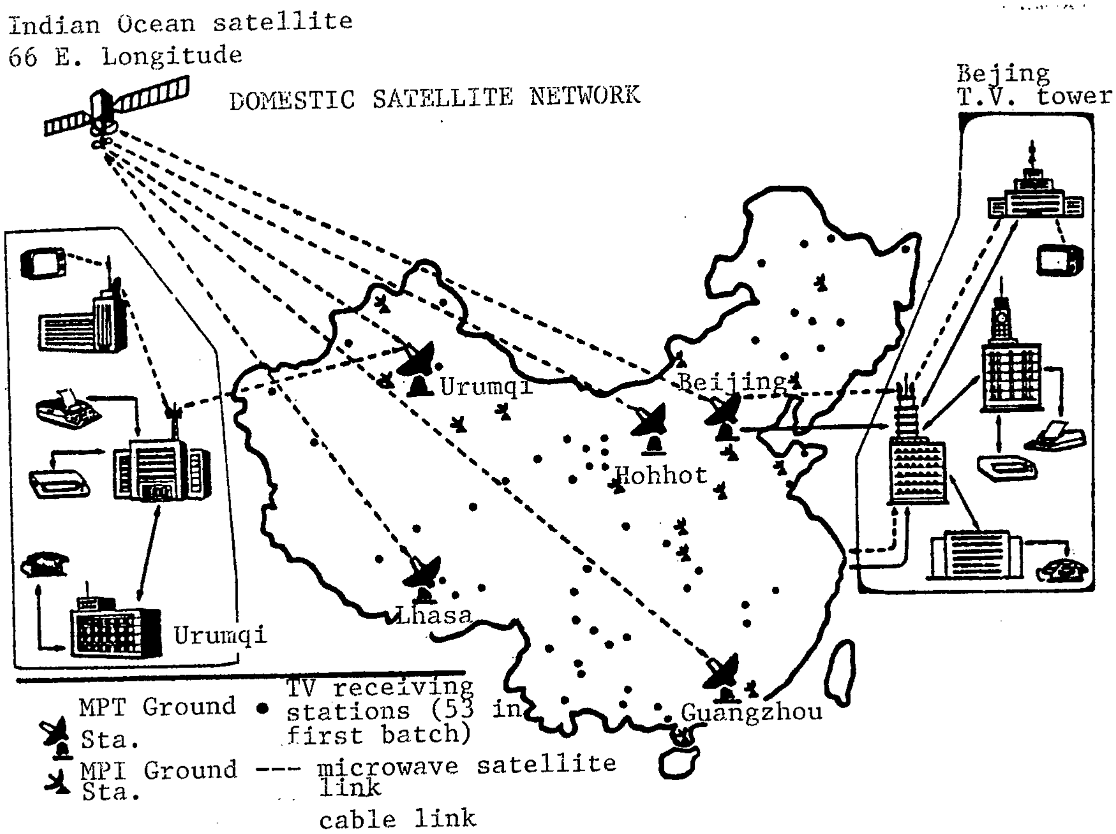
NATION COMPLETES FIRST DOMESTIC SATELLITE COMMUNICATIONS NETWORK

Beijing RENMIN RIBAO in Chinese 9 Jul 86 p 1

[Excerpts] After 2 years' work, China's domestic satellite communications network has been completed. At simultaneous ceremonies held on the afternoon of the 8th at the Central Satellite Ground Station in Beijing, and at the satellite communications stations in Urumqi, Hohhot, and Lhasa, the system was formally inaugurated. Vice Premier of the State Council Li Peng expressed congratulations on behalf of the Council.

Begun in 1984, the network took less than 2 years to complete. In addition to the Beijing Central Ground Station, completed in November 1985, the stations in Lhasa, Urumqi, and Hohhot were all completed in the first half of 1986. The Guangzhou ground station is undergoing "debugging."

At present, telephone, telegraph, data and facsimile are being exchanged between the Beijing facility and Urumqi, Hohhot, and Lhasa.



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INSTITUTE OPERATIONS, PERSONNEL TRAINING DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 10, 12 Oct 86 pp 41-43

[Article by Special Correspondent Ding Mu [0002 2606]: "Spend Money to the Best Advantage; Professor Li Ming Talks on Questions of System of Institutions of High Learning and Scientific Research"; edited by Fang Qiang [2075 3677]]

[Text] Biographic Sketch: Professor Li Ming [6786 2494] graduated from Jiaotong University, Shanghai, in 1951. In 1958, he conducted his research in the dynamic stability of gear millers in Czechoslovakia. The result was appraised by the University of Prague, and a precedent was created in conferring on him the degree of candidate doctor of technology. In 1959 to 1960, he was one of the principal authors of a series of articles entitled "On the Law of Internal Contradictory Movements of Machine Tools Based on the Design for Modular Lathes." In 1982, he was in LBF Research Institute of FRG assisting in the research of designing fatigue-resistant structures, and two volumes of monographic work were published (in English). A Chinese version will soon be published by JIXIE GONGYE CHUBANSHE. Professor Li has written more than 10 theses and many times given lectures at international academic seminars and in foreign countries. He is now Director of the Teaching and Research Office of Harbin University of Technology, deputy chief engineer of the No 2 Motor Vehicle Plant, and the dean of precision machinery department of China University of Science.

I visited Professor Li Ming on the eve of his foreign trip. That was his third trip to West Germany on behalf of No 2 Motor Vehicle Plant after many trips to Japan and Czechoslovakia. I enquired about his views on scientific research in institutions of higher learning on the basis of his observations abroad. These views have been compiled and are being presented here, and I hope the readers will find them interesting.

The Systems of Institutions of Higher Learning Should Be Wider Apart, More Working Graduate Students Should Be Trained

Professor Li Ming said: Scientific research and the academic system of institutions of higher learning have separate contents in appearance, although they are in fact closely related. Some time ago, there was a controversy over whether 4 years or 5 years would be better for science and engineering in

universities. Some people said that the 4-year system is adopted in England and the United State, while the 5-year system is adopted in the Soviet Union. I do not share this view. The 5-year system is adopted not only in the Soviet Union, but also in Germany. Therefore, we cannot base our observation on the outward appearance. We should say that both the 4-year and the 5-year system are adopted in China. However, we can compare the two systems. The graduates under the 4-year system generally feel that they have not learned enough, while the graduates under the 5-year system are able to work independently and to engage in scientific research. Some of them even took up advanced study. In this way, we can train a large number of students and reduce the total amount of learning time. Many of the graduates under the 4-year system have taken the examination for graduate students and have to spend another 2 and one-half to 3 years, totaling 6 and one-half to 7 years. This is not worthwhile. At present, England and the United States do not interfere with the system in any way. The students can enroll easily, but the drop-out rate is fairly high and only a small number who can study hard and resist the temptations of this dazzling world can finally succeed. The teaching system in Japan and the Soviet Union is very strict, and the drop-out rate is lower. In Germany, the state finances the students' university education, the teaching is tightly organized, and the training of qualified personnel is assured. China also finances education. Like Japan and Germany, which became strong after the war, China should use its funds to the best advantage. In the selection of students, we should subject them to a strict entrance test, after which, we should keep everyone of them so that no time and money will be wasted. China also has a 3-year system for universities and vocational colleges. The 3-year system, like the 5-years system, is not much different from the 4-year system for undergraduate course. We should have 2 years for a special course and 5 years for an undergraduate course so that the two systems can be wider apart. When the state's economy is not quite developed, we can have more special courses under the 2-year system, and then let the student continue his study without leaving his job. In Germany, the student can become an engineer after 2 years in college, although his title is preceded by the letter "C." Japan also has many short-term university courses designed to meet social needs.

On the question of advanced study, Professor Li Ming said: Germany has no college for graduate students, and even the universities hold no such classes. The time for undergraduate courses is nominally 5 years, although it is generally 6 years. The students have to write theses in their 6th year, and after graduation, will be equivalent to our masters of art. They may remain in the university as assistant professors, join the research institutes, or write a thesis on their favorite research subject to apply for a higher degree. After certain questions and answers, the qualified universities or research institutes can award them the PhD degree. Of course, there is also the tutor system. People studying for a doctor's degree must have a tutor beforehand. The tutor may be working in the same unit, or be obtained from some other source. The student having problems may approach the tutor for help and the tutor need not watch him everyday. The units conferring the academic degree usually have their own trainees, but may also be glad to confer the degree to others who are genuinely learned. They believe that in so doing, they would be doing a service to society. This is an effective incentive to efforts in study resulting in improved quality and increased

quantity. It is also a good way to discover and train talents at small expense. In China, there are many young working technicians and teachers who are devoted to their research. Some of them are restricted by their schooling background, and some have difficulty with a certain subject. For these reasons, their talents cannot be recognized. Long ago, some people already suggested something like a working graduate student program which also appeared in some documents. However, no action has so far been taken, and the urgent needs of the youths and the state do not seem to be taken seriously.

Subjects To Be Chosen for Research in Institutions of Higher Learning Should Proceed from the Needs of Production Development

Professor Li said: China's scientific research has had its ups and downs. In the case of motor vehicles, for example, we followed the Soviet Union's example at the very beginning. It gave us only the blue print, but not the means of designing, testing and research. At that time, we had to start everything from scratch. We could still manage it, but the problem was that we did not know what to do later. At the early stage of the cultural revolution, when we had designed our own vehicles, we could only take apart this and that car, produce the drawings, and concoct new designs which seemed to include all the fine features. Experiments were later conducted. How? We went to Qinghai, Xizang and some deserts to drive the cars until some parts were found worn out. These parts were strengthened again, but we had no idea whether the material, the technique, or the design was wrong. We thought everything was based on science and tested in practice, but the fact was that we lack scientific data and could only imitate. It was not until after the 3d Plenary Session of the 11th CPC Central Committee that we set up the testing facilities. Today, however, we have another wrong tendency. Many people are now engaged in research, but the research is rarely based on China's national conditions. In the case of vibration, for example, the modern method of modality analysis can help us find out the mode of vibration. It can help reduce the weight of airplanes. In machine tools, however, weight is not the main problem. At present, many schools are still using modality analysis in their vibration research together with some complex imported equipment. How did this subject come to be assigned? Mostly from foreign magazines. The factories have no interest and the schools have no faith in it. Thus the money already spent did not produce good result for the factories. Therefore, in conducting applied research, the institutions of higher learning should use their funds to the best advantage. Instead of the immediate or the very long-range needs of the factories, they should be concerned with the needs in the next 4 to 5 years. The main problems with machine tools is that of precision. Our precision machine sector has conducted research in the use of microcomputers to control processing with lathes. The purpose of the research is to used lathes of not very fine precision to process very high precision parts. At the time of cutting, the cutter is usually deformed by heat, and after cooling, the part has the problem of shrinkage. If, for example, a computer-controlled part is attached to the cutting frame, three-quarters of the error can be compensated, leaving only one-quarter of it. In other words, it is a 75 percent compensation. Popularization of this research is by no means a distant goal; the factories can reap the fruits immediately.

In China, many people after graduation have remained in their own universities as teachers, and do not know much about the realities of the factory. In Germany, whenever a vacancy for a professor exists, the candidate is not chosen from the same university, but recruited openly and through a competitive examination. All applications will be examined by an academic committee. Factory experience is a prerequisite for the application, without which, the applicant cannot join the competitive examination. All the examiners have practical experience and can be counted on to make the right choice. This procedure is stipulated by law. We can do the same thing. Without practice, the students out of school will be divorced from reality.

Readjustment of Personal Relations Is the Key to Higher Efficiency

Speaking of efficiency, Profession Li said: In my opinion, first of all, personal relations are very important. In LBF Research Institute, I feel that the relations between the old and the new intellectuals, and between the intellectuals and the workers are in some way more cordial than in China. The professors are quite familiar with experiments, but have no time to write any articles. His main duties are to set the orientation, look for the sources of funds, and choose the tasks. The assistant professors and lecturers undertaking the tasks need money for their work and have to rely on the professors. The professors also understand that the detailed work must be done by these people. There is thus mutual reliance. The relations between the workers and the institute directors are also fairly good. The workers know that although their salaries and positions are not so high as the directors', their actual life style is by no means inferior, because after work, they have time to take care of their walls, floors and furniture. The professors have higher positions and salaries, but less time, and their homes cannot be exactly in good order. People must realize that they need one another, but must also do their own jobs well. Some of our people are fond of interfering with other people's affairs. At the door of the laboratory of Tokyo University is hung a small blackboard on which the materials which are needed are written together with the dates when these materials would be needed. The logistics personnel of the university come to copy from this blackboard everyday, and deliver the required materials in due time. If the materials cannot be delivered in time, some explanation must be given beforehand. When I told the teachers about this, they were quite impressed. Some of them had to run around for several days before they could find the screw or resistor they want. In our units, if some people do not do their work well, I can only refuse to sign my name for their promotion. Without my signature, they cannot be promoted. I have only this power, but not the power to have them replaced.

The high efficiency of LBF Research Institute is shown by the fact that each researcher can attend to five or six different projects, whereas, in China, a fixed number persons are assigned to one group permanently. The advantage of one person working in several groups is that he can make use of his own specialty in several projects. In the process, they can find out about the progress of work without the briefing sessions we have. Each week, whatever each person has completed is fed into the computer, and anyone can retrieve the information from the computer and cooperate accordingly. Computers can be very time-saving. In their message center, one girl can operate a telephone

exchange with 1,000 lines, and take care of the incoming and outgoing mail, and the attendance time cards. She also serves as a guard and a receptionist. In China, at least three persons are required for all these jobs. The reference materials are handled by two persons--one old and one young person. The materials received are sorted out, numbered, and fed into the computer to be revised or read. These two also have time to do some typing. In an institute with 100 persons, there is only one director. The kitchen is also under the charge of only one person. Lunch is served to everyone according to the attendance sheet. The lunches are taken out of a refrigerator and then heated. The same person also takes charge of the dishwashing machine and other cleaning jobs besides attending to unexpected guests. All these workers are included in the 100 mentioned.

Li Ming said: One day in Germany, I received and made 30 phone calls. Some of them were domestic calls and others were to or from the United States, Czechoslovakia, Austria and Italy. To make 30 long-distance calls in China would take more than 1 month. I think China can do better provided some effort is made. Putting up telephone lines costs much less than building railways, and it is certainly worthwhile for some of the funds earmarked for railways to be diverted to telephone service. China builds 500 km of railways each year, or 50,000 km in 100 years, and then the railways will only be up to India's present level. We do not know whether railways are still needed 100 years later. Installation of telephones is much faster. It requires no high technology and no foreign exchange. With more telephones installed, railway mileage can certainly be greatly reduced. This is a matter of efficiency.

There are duplicating machines in every corridor of Tokyo University. These machines are very convenient and can be operated by putting in some coins. What deserves to be mentioned is that these machines are rented from various companies, and these companies send their personnel over for their regular maintenance. Computers can also be rented. In view of the higher utilization of expensive equipment and the effective way of upkeep, China should quickly adopt and develop these methods to avoid waste.

9411
CSO: 4008/2013

PRODUCTION, EXPORT OF INDUSTRIAL CERAMICS DISCUSSED

Shanghai WEN HUI BAO in Chinese 7 Aug 86 p 2

[Article by Xia Zhenfei [1115 7201 7204]: "Focus on Production and Export of Industrial Ceramics"]

[Text] According to Wu Shengyu [0702 4939 1946], an engineer in the Ministry of Light Industry, Shanghai Economic Zone should try to make a breakthrough in the production and export of industrial ceramics (or modern technology ceramics).

Wu pointed out that as science and technology advances, the thermal, electric, mechanical, chemical resistant, optical, magnetic and acoustic properties of industrial ceramics are being widely used. Various countries in the world are funding the development of new ceramic materials.

According to Wu, China is the first country to invent ceramics. However, it is falling far behind the leaders in the world. According to statistics, the international trade of ceramics for daily use is $2.8 billion per year. Japan is the largest exporter, at $0.5 billion a year. In recent years, China stayed at $1.0 to $1.5 billion a year. The total volume of industrial ceramics worldwide is approximately $4 billion. Japan exports approximately $2 billion. China essentially has no export in this area.

Wu believes that Shanghai Economic Zone has certain advantages in developing industrial ceramics for export. The amount of ceramics from the zone accounts for 22 percent of the total national exported. By 1990, the goal is to reach $1 billion in ceramics export, which is one-third of the national total. This is quite feasible. The emphasis is to jointly develop the technology. Brand names such as Jingde Zhen and Yixing should be the leaders to use the standards for high quality products in the world as our goals. Jiangsu can be the base for developing industrial ceramics. The technology and equipment in Shanghai can be used to assist the development and production of electronic ceramics, electrical ceramics, construction and sanitation ceramics, functional ceramics and engineering materials in large quantities in order to compete in the international markets to earn more foreign exchanges for China.

12553
CSO: 4008/2010

TECHNOLOGY IMPORT STRATEGY FOR ECONOMIC DEVELOPMENT ZONES

Guangzhou KAIFANG [OPEN POLICY] in Chinese 8 Sep 86 pp 27-29

[Article by Li Yinghao [2621 5391 6275]: "Economic Development Zones Must Adopt a Correct Technology Import Strategy"]

[Text] Since China further opened 14 coastal cities in 1984, the State Council has successively approved the establishment of economic development zones [EDZs] in 11 of these cities. From their inception, the EDZs have had to face the question of how to import technology. This article discusses some issues relating to technology import strategy in EDZs.

1. Choosing a Correct Technology Import Strategy

The further opening of the Chinese coast and the rise of urban economic development zones have been the focus of worldwide attention and caught the intense interest of foreign investors. For more than a year, the zones have been conducting extensive talks with foreigners and initiated technology import. Some have imported foreign capital and technology and put up a number of industrial projects with outstanding social and economic results, evidence of the correctness of the policy of establishing EDZs in these cities. However, some opened cities have not settled upon a correct import strategy promptly. This is because they are not ideologically prepared for the establishment of EDZs. Nor do they have the required personnel. They are inexperienced and, after being isolated and cut off from other nations for years, have no access to information and lack the necessary understanding of foreign economic, technical, and market conditions. They have also failed to study and analyze seriously the state of technology inside the country. Two things characterize their import talks with foreigners. First, lack of planning. Some have released a list of technology projects they hope to import. But still they ended up discussing whatever the approaching foreign businessman had to offer. These zones have no idea what to import and are unable to make up their minds. They are highly ineffective and have missed many an opportunity. Second, they are merely groping along. A quantity of inapplicable and non-advanced technology has been imported that does little to advance the locality's economy or technology and even becomes a burden on it. The result is economic losses. It can thus be seen that whether the import strategy is right or wrong, good or bad directly influences the success or

otherwise of an economic development zone. Only after extensive multi-area research on China and other nations and careful consideration can we, taking realities as our point of departure, draw up a correct technology import strategy that would define the scale and speed of development, and go about importing scientifically and in a planned way. And only thus can we take more targeted, flexible, and attractive measures to make EDZs a success.

2. Defining the Mission of an EDZ is a Prerequisite for Determining its Technology Import Strategy

In July 1984 a State Council official answered questions by RENMIN RIBAO reporters relating to a number of policy issues on further opening 14 coastal cities. He pointed out, "The purpose of establishing economic development zones is to vigorously import advanced technology urgently needed by China's four modernizations, particularly technology- and knowledge-intensive projects and new industrial projects. Our government has implemented preferential policies in economic development zones, set up joint and cooperative ventures with foreign businessmen, organized scientific research institutions jointly, entered into joint production and design, and initiated new technology and new products. Foreign businessmen are also welcome to set up foreign-owned enterprises in the zones using advanced technology and equipment. Some economic development zones must also develop into international entrepot trade bases." It is clear from this that the primary mission of EDZs is to import advanced technology and develop new technology and new industries. Undoubtedly this guiding ideology is entirely correct. In the early days of the zones, however, people understood this only superficially, were influenced by the model of certain special economic zones [SEZs], and neglected to study and draw up an import strategy conscientiously. Consequently, their guiding ideology went awry in a number of ways. First, they were impatient to produce results. Eager to create an imposing modern city filled with skyscrapers in a short time, or at least to build up the 1- or 2-square kilometer start-up area, they crowded each and every project into the zone. Second, in their scramble for projects, they chose not to be selective. No serious effort was made to analyze and assess the technical feasibility and economic rationality of proposed projects. Never mind what kind of technology or equipment--they wanted it all. Third, they hoped to "achieve prosperity through trade," believing that an economic development zone "must develop commerce first of all to accumulate construction funds" and that "economic development zones should begin by tackling the tertiary industry." Hence their enthusiasm for commerce. Not knowing the purpose and mission of the establishment of EDZs, they could not decide upon a correct feasible technology import strategy, which led to certain errors and mistakes in their work.

It must also be pointed out that developing EDZs is neither setting up a few additional SEZs nor building a few mini-SEZs. They are called economic and technology development zones and the key word is "technology." Their central mission is to import advanced technology and develop new technology. In considering and determining a technology import strategy for EDZs, therefore, we must clearly define their mission and pay particular attention to two major distinctions.

First, distinguish between EDZs and SEZs. Economic development zones in China's opened coastal cities differ from both the countless export processing zones, free trade zones, investment promotion zones, and industrial parks that can be found all over the world and China's four SEZs. Certainly special economic zones are also intended to attract advanced technology, equipment, and management know-how, expand export trade, and obtain increasing foreign exchange earnings, etc. But their import projects mostly have to do with industrial projects or the manufacturing of exports, the idea being to take advantage of their inexpensive labor, cheap land, and low production costs to break into the international market. In SEZs, therefore, industrial projects can combine a technologically advanced industry with a labor- or capital-intensive one. The basic mission of EDZs, on the other hand, is to enhance China's own capability to develop and speed up scientific and technical progress through the import of advanced technology, and ultimately to form a technology system with Chinese characteristics. Therefore, the EDZ projects should stand out on account of their technology- or knowledge-intensiveness. The starting point of this kind of technology import should also be a little higher. Needless to say, EDZs should also develop new industries and new export products through importing and developing new technology, increase foreign exchange earnings, and accumulate construction funds. Yet we would be wrong if we see EDZs merely as a means of obtaining certain instant production capacity and short-term benefits, a foreign-exchange earner or a creator of additional jobs. Even more ill-advised is to dump on them any number of technically mediocre projects and even "sunset industries." Given the massive amounts of funds spent on the infrastructure in the zones to create a favorable investment climate, it would indeed be a money-losing proposition to import technically mediocre projects.

Second, distinguish between EDZs in different places. The various opened coastal cities vary considerably in their levels of economic development, industrial foundation, technical strength, and resources. The specific missions of EDZs in these cities should not be identical. We should not lay down a single technology import strategy in accordance with a particular model and apply it rigidly to each and every EDZ. Each EDZ must submit to the guidance and coordination of the general economic and social development plan of the city in which it is located, as well as its scientific and technical development plan, and decide its technology import strategy and detailed plan in accordance with its status in the city and the environs, its functions, and its mission.

3. The Starting Point for Technology Import Strategy is Developing and Using Local Resources and Vitalizing the Local Economy

There is no contradiction between an EDZ zeroing in on the vitalizing of the local economy and fully utilizing local resources first, on the one hand, and its mission of importing advanced technology and promoting the establishment of a new technical system with Chinese characteristics, on the other. This does not mean that the EDZ should be eager for quick success and instant benefits and become short-sighted. Rather, it is only trying to better serve the economic development and technical progress of the locality, environs, and even the economic hinterland. If an EDZ takes local economic vitalization and

the utilization of local resources as the starting point of its technology import strategy, it will be in a better position to expedite the technical transformation of local old enterprises and the adjustment of the agricultural structure and help bring about the two shifts (from exporting raw materials to exporting manufactured products, from exporting primary products to exporting processed products) in the export mix.

By importing advanced applicable technology while basing itself firmly on the development and utilization of local resources, a EDZ can, first, make the best use of local advantages, significantly increase the city's export and foreign-exchange earning capacity, and achieve quick positive results with minimal investments; second, upgrade the use value of resources, stimulate local economic development, and boost national income; and third, contribute to horizontal economic cooperation. This can also be called import with an advantage.

4. An Important Principle in Determining the Technology Import Strategy is to Take Realities as the Starting Point and Act in Accordance with One's Ability

One important principle that we must adhere to in building an EDZ and importing technology is to take realities as the starting point at all times and act in accordance with one's ability. If we blindly pursue high-speed growth, high tech, and large-scale projects in disregard of our own conditions and fail to seriously analyze needs and possibilities, the result is bound to be more haste, less speed. A number of special zones in the world provide us with many examples of failure in this aspect. Some of our own EDZs have also learned a lesson in the early days. To insist on taking realities as the starting point and doing what one is capable of, we must now correctly handle several relations:

First, we must handle the relations between the direction of technology import as a long-term effort and its more immediate objectives, and between high tech and applicable technology. Importing high tech, promoting the establishment of a technical system with Chinese characteristics, and setting up a host of capital- and technology-intensive enterprises are clearly a crucial long-term mission for an EDZ. But this is not something that can be achieved readily overnight. We must fully realize that at a time when a handful of economically developed nations are trying to monopolize advanced technology by every possible means and when trade protectionism is on the rise, the difficulty and complexity of importing high tech must be considered in the light of our own capabilities (including the capabilities to pay, to repay in foreign exchange, to assimilate technology, and to export.) Take our ability to pay, for instance. Usually, for every $100 million worth of technical projects imported, we need 500 million yuan in accessory funds. In addition, there must be a sound technical structure, industrial structure, and product mix. Therefore, even as it works hard to create conditions for importing high tech, an EDZ must first set up a number of enterprises with local characteristics that require little inputs, produce substantial outputs, have a short construction period, earn a good deal of foreign exchange, and generate good economic results. In the first 2 or 3 years, in particular, it must concentrate on relatively advanced, applicable, and effective technology

and establish a batch of enterprises that develop and utilize resources and are export-oriented. They should be small-scale enterprises that require little capital, operate on a relatively high technical level, and make original products. They should also accumulate funds and experience for importing high tech and train personnel.

Second, the relations between technology import and the technical transformation and development of old urban areas. Technology import must take into full consideration the city's economic and technical realities and, as much as possible, dovetail with the plan for the old urban areas in funds, materials, technology and comprehensive balance. An EDZ must play its role as a window and the center of two fans to the full. That way, we can ensure a solid grounding for the development of the zone, on the one hand, and provide leadership for the technical progress of old urban areas, on the other, so that the imported technology can be digested, assimilated, popularized, and innovated upon in the old urban areas promptly and soon constitutes a new technical level in the entire city and even region.

Third, the relations between imported hardware and imported software, between import and absorption and assimilation, between importing technology and learning scientific managerial experience. EDZs cannot content themselves with importing a set of modern equipment or even an entire production or assembly line. Not only is that extremely wasteful of foreign exchange, but it will also make us dependent on foreign companies. The import of software and technical know-how must be strongly emphasized. The import of technology should also be combined with the acquisition of scientific managerial methods and experience. Every project should gradually increase its proportion of domestic raw materials, parts and components systematically in a planned way and progressively bring about the domestication of a product. Moreover, even as we import foreign technology, we should take pains to redouble our efforts to popularize the application of domestic scientific research achievements and accelerate the absorption, assimilation, and innovation of imported technology.

12581
CSO: 4006/177

DEVELOPMENT OF MOUNTAIN AREAS LINKED TO S&T PLANNING

Beijing GUANGMING RIBAO in Chinese 14 Sep 86 p 1

[Article by Zhai Huisheng [5049 1920 3932]: "Comprehensively Develop Mountainous Areas; Include Them Within Spark Plans"]

[Text] During the Third National Science and Technology Conference on Comprehensively Developing Mountain Regions held a few days ago, responsible persons in relevant departments of the State Science and Technology Commission responded to questions put to them by reporters from this newspaper regarding comprehensive development of mountainous regions in this country.

Question: How can we recognize the relations between comprehensive development of the mountain regions and the "spark plans"?

Answer: One of the origins of the spark plans is just exactly comprehensive development of mountain regions, and now we have also placed comprehensive development of the mountain regions within "spark plans."

There are two levels to the "spark plans": one is the serial development of industries and the other is the comprehensive development of regions. The development of mountainous regions is a focus of regional development. In taking control of regional development, we are looking for how differing regions are to rely upon science and technology, and to gain experience in the coordinated development of the economy, society, and ecology. This includes establishing "spark plan" demonstration areas in qualified mountainous areas. There have been at present some 10 technology development projects from mountainous areas included in national "spark planning."

Question: What is the strategic thinking of the Science and Technology Commission regarding the development of mountainous areas during the Seventh 5-Year Plan"?

Answer: Development of mountainous regions will continue to follow the "Path of Taihangshan." But we should fully recognize the long term nature, the varying conditions, and the complexity of the effort regarding the mission of technical development of the mountainous areas. We must avoid rushing into things, and definitely cannot plan with false intentions and seek after only form and bluster, but instead must pursue stability, the facts, and be thoroughgoing.

First of all, we should perfect our scientific policies. That is, we should study development strategies for the comprehensive development of mountain regions and draw up development plans, all in line with local conditions, and we should emphasize the integration of "short-term considerations" with "long range planning." "Short-term, appropriate level, with quick results" is one way to realize long-term goals, but if there is no overall development strategy, then "short-term, appropriate level, with quick results" will be misguided. What we mean by development strategies are development strategies for a mountain system or its subdistricts, in which we want to break through administrative and county boundaries. Planning, then, is to particularize strategic thinking, and the county may be the unit of formulation. The Science and Technology Commission requires that the approximately 10 mountain areas that have been included in the national "spark plans" produce through study over 6 months time a rough sketch for development strategies, then use another 6 months to make plans within experimental units. Second, we want to stress that reliance on the association of science and technology with development makes up the "two wings" of economic development in mountainous regions. Why is it that mountainous regions are backward? Looking at it from an historical perspective, that was brought about by the outflow and washing away of "material flows" and "intellectual flows" from mountainous regions. If we are to return the "material flows" and "intellectual flows" back to the mountain areas, we must develop lateral associations that transcend districts. Only in this way can the advantages in resources of the mountain areas be closely integrated with science and technology, or can they become product advantages and economic advantages to enrich the mountain peoples.

Third, in the process of the comprehensive development of the mountain regions, science and technology commissions at each level should stress complete scientific and technical policies for mountain area development and also the arranging for science and technology to be brought into the mountains. If we are to be good advisers to each level of government, we should coordinate relations between relevant departments to aid in making the most of each aspect.

12586
CSO: 4008/2006

CONFERENCE DISCUSSES NEW PROBLEMS IN RESTRUCTURING S&T

Beijing GUANGMING RIBAO in Chinese 17 Sep 86 p 2

[Report by Liu Sa [0491 7366]: "We Must Stress the Resolution of New Problems In the Restructuring of the Science and Technology System"]

[Text] Recently, at a joint conference of the directors of the science and technology commissions of coastal cities and of four northeastern cities, many science and technology commission directors spoke of new problems they had encountered during the restructuring of the science and technology system. All felt that some of those problems were quite common and that relevant leading departments should pay special attention and should resolve them in order to promote the healthy development of the restructuring of the science and technology system.

1. The problem of expanding the authority of restructured units. Relevant documents from the State Science and Technology Commission and the State Commission Restructuring of the Economic System have clearly provided that we are to expand the authority of restructured and experimental units and implement an institute director responsibility system, but in the actual implementation work, governing departments of many experimental units have still governed restructured and experimental units too closely because of influence from department ownership. It is even so that institute directors do not have the authority to nominate a deputy director, nor the authority to employ mid-level cadre, nor the authority to employ necessary personnel or to refuse to accept unnecessary personnel. They are especially without the authority to deduct parts of funds in accordance with regulations. The directors of the science and technology commissions felt that all restructured experimental units should implement an institute director responsibility system and that relevant governing departments should actively support this, which would give the institute director true duties, true authority, and true responsibility with which to do a good job of restructuring.

2. The problem of tax revenue. Many municipal science and technology commission directors said that because there are currently still many problems regarding the loosening of enterprise authority and in implementing factory director responsibility systems, when to that is added a lack of necessary policies and safeguards, then there is a lack of a sense of urgency by enterprises regarding the needs for technology advances. Therefore, the

income derived by institutes from the transfer of rights to achievements or from undertaking technical consulting services is very limited. Income for many restructured experimental units is in fact mostly dependent upon selling products in intermediate testing. This year, relevant state departments issued documents regarding taxes derived from the certification of intermediate products, in addition to which institutes and enterprises alike will pay energy taxes and transportation taxes, all of which leads to very great difficulties for the expenses of restructured units. It has been learned that of seven experimental institutes in Guangdong Province, four have requested to not be experimental units. There have also been adjustments in the reductions of operating expenses allocated to Shanghai and Tianjin, the pace having been slowed. Some of the municipal science and technology directors said that state policies should keep up with the restructuring, but at present they are quite insufficient.

3. The problem of opening up the channels for science research capital construction funds. For quite some time now, science research units have not had investment in equipment transformation, have not had capital investment, and there have been many outstanding bills for research and living housing and for the acquisition and renovation of instruments and equipment. Income from implementing the compensated contract system has only solved the problem of "a warm dwelling and a meal," but is not sufficient to solve the problems just mentioned. If it stays this way for long, it will seriously affect science research work and the enthusiasm of scientists and technicians. Among financial outlays, the Ministry of Finance has one item entitled "funding of science research capital construction," but funds of this kind are very few in many cities, and are even equivalent to "nothing." The directors of the science and technology commissions request that in annual financial budgets, relevant leading departments should allocate a certain amount for science research capital construction expenses to support the building of institutes.

12586
CSO: 4008/2006

REQUIREMENTS FOR PATENT APPLICATIONS OUTLINED

Beijing GUANGMING RIBAO in Chinese 3 Sep 86 p 3

[Report by Gan Ning [3927 1337]: "Conditions Under Which to Obtain Patent Rights"]

[Text] The restructuring of the economic system is progressing in depth. With the development of the drive toward socialist modernization, the patent system has increasingly played an important role. The patent law promulgated by this country in 1984 is the core of the patent system, and it is currently promoting development of science and technology in this country.

Patent law bestows patent rights upon inventors and creators, and there must be certain conditions for obtaining of these patents. It is clearly provided in this patent law that "inventions and new types of applications that are granted patents should be novel, creative, and applicable."

Novel. Patent law in this country uses criteria of time and place to acknowledge that patented inventions and new types of applications are or are not novel. By the criterion of time is meant the day on which the patent application was made. If before the date of application similar inventions and new types of applications have been publicly announced, or have already been publicly used, or are publicly known, then this is not novel. If there are two or more applicants for similar inventions or new types of applications, then it should be noted who was the very first to submit an application. For the person who applied first, his or her invention or new type of application is novel, while others are not. The criterion of place requires that the invention or the new type of application is not publicly known internationally, nor that it has been publicly used within this country or is publicly known in other modes. Those inventions or new types of applications that fit the two criteria just described are novel.

Patent laws in this country also provide that if the invention or creation for which a patent is requested comes under one of the following conditions within 6 months before the day of application, its novel quality is not lost.

1. If it is first exhibited at an international exhibition that is run by or acknowledged by the government of China;

2. If it is first announced at scheduled academic conferences or technical conferences;

3. if others disclose the matter before receiving the agreement of the person making the application.

Creativity. The law requires that when compared to technology existing before the day of the application, the invention for which a patent is sought is clearly more advanced in substantive characteristics that are outstanding; and the new type of application need only be substantive and advanced. For the most part, there are the following kinds of creative inventions and new types of applications:

1. Ones that fill a certain void within a scientific and technical field, or that open up a completely new scientific or technical field. 2. To undertake improvement and development on the basis of existing technology, creating a new technology that is a step ahead of existing technology. 3. Using material that is already known, create new properties through various combinations. It is not creative to simply make small improvements of existing technologies or to make combinations that do not produce new properties.

Applicability. Regarding applicability, the patent laws provide that "the inventions and new types of applications for which patents are requested be able to create or be used, and also that they be able to generate positive results." Without use value, inventions or creations that cannot be used in production operations are regarded as being without use value. From the point of view of actual practice, inventions for which patents are sought are generally scientific achievements for which actual practice has proven an effectiveness. This is still some distance from being used in large scale industrial production, but as long as the possibilities for an invention to create or to be applied may be foreseen, this may be seen as having applicability.

When the invention or new type of application for which a patent is being sought has the three conditions just mentioned, it can be granted patent rights. But inventions or creations that violate the laws of the state, social morality, or that obstruct public interests cannot be given patent rights. In addition to this, patent law also states that patent rights shall not be given to the following things: scientific discoveries; regulations and methods for intellectual activities; methods for the diagnosis and treatment of illness; foodstuffs, drinks, and seasonings (not to include methods of production); substances obtained from pharmaceuticals and chemical means (not to include methods of production); varieties of animals and plants (not to include methods of production); substances that have been obtained through changes using atomic energy; etc.

New types of applications. This refers to new plans for the form or structure of products or for combinations of form and structure that are in keeping with applications.

12586
CSO: 4008/2006

S&T 'MOONLIGHTING' ACTIVITIES DEFENDED

Beijing GUANGMING RIBAO in Chinese 4 Sep 86 p 1

[Text] Four scientists and technicians from Taizhen used their leisure time for installing and debugging X-ray machines, which was said to "take advantage of the restructuring" and to be "engaging in unhealthy practices"; they were not allowed to accept the income they derived therefrom. This situation is representative of things going on at present. Today, this paper has published letters and investigative reports regarding these affairs in order to clarify that any actions that infringe upon the legitimate rights and legal income of scientists and technicians are all in error and should be stopped quickly.

For scientists and technicians to engage in technical efforts or in technical services during their leisure time (or "moonlighting," for short) is a new thing in the restructuring of this country's science and technology system. Practice has shown that this meets the needs of the modernization of science and technology in this country, is in keeping with the rules of socialist commercial and economic development, and that the social and economic results brought in by it are quite apparent. In their resolution regarding the restructuring of the science and technology system, the Central Committee approved of these activities and also made clear provisions regarding relevant policies and income distribution. Consequently, this question of moonlighting by scientists and technicians in real life has encountered difficulties, and it has had its ups and downs. Some oppose the earning of appropriate compensation through moonlighting by scientists and technicians as being an unhealthy tendency, and some units have taken over the legal income of scientists and technicians, allowing the problem of remuneration for scientists and technicians to be a "test that everyone must take," even instigating the public to "expose and inform against." Because they have used their leisure time to work and have earned some remuneration, some scientists and technicians have been investigated on several occasions, time after time "profound investigations" have been written against them, if they were party members, they were not allowed to reregister. . . Doing things in this way, how much further could it be from relevant provisions in the resolution by the Central Committee regarding restructuring of the science and technology system?

In some units, if scientists and technicians just sit around with nothing to do, everyone is comfortable and there is no trouble; but if someone puts out a

little more effort, makes a few more contributions, all manner of difficulties are raised and there is a series of personal attacks. Would you not say this is strange? To be sure, this is a reflection of the influence of thinking from the past and of old habits in the minds of a few comrades. In the view of some comrades, moonlighting by scientists and technicians to earn compensation can lead to "everything being for the sake of money," will "corrupt the mind and spirit," will "lead to contradictions," etc. Actually, these are all prejudices. Having these sorts of prejudices, the vitality created in society and resultant economic results due to the moonlighting of these scientists and technicians cannot be seen, nor can it be seen that the compensation earned by these scientists and technicians is only a small part of the value they have created, nor can it be understood that the compensation for which scientists and technicians work to improve themselves is a proper right and interest.

With the condition that they first complete their primary work, when scientists and technicians use their leisure time to engage in scientific and technical activities, this signifies that aside from expending a certain amount of labor in their primary work, they have also expended a certain amount of effort in their leisure time. If we say that the compensation that they have received from their primary job in the form of wages is reasonable, then the compensation they derive for scientific and technical labor in their leisure time as bonuses or in other forms that is in accordance with relevant policies is similarly reasonable, and both are in keeping with the socialist principle of distribution according to labor. Any person who for any excuse or by any means infringes upon the reasonable income obtained by scientists and technicians in their spare time, are in violation of the basic rights regarding civilian compensatory labor, which action is thereby prohibited.

We advocate that leading comrades at each level become enlightened regarding this problem. They cannot keep their eyes constantly on the little money that scientists and technicians earn through their labor, nor even more can they be deliberately provocative, stirring up trouble for all sorts of reasons and making personal attacks against scientists and technicians. During this period of restructuring there should be an excellent atmosphere throughout society, so let scientists and technicians boldly, courageously, and fearlessly contribute more to the four modernizations. It is our belief that as people's concepts change, as each policy and measure is gradually completed and perfected, moonlighting activities of scientists and technicians will be treated justly and reasonably.

12586
CSO: 4008/2006

'FREE' TECHNOLOGY IMPORTS DISCUSSED

Tianjin JISHU SHICHANG BAO in Chinese 7 Oct 86 p 3

[Article by Cao Yan [2580 1484]: "Analysis on "Free" Technology Imports"]

[Text] Technology, as a special commodity, should have a price. It is usually not supplied free of charge. However, in recent years technology import contracts (involving both technology and equipment to be precise) often include the "free" use of technology.

Why do foreign businesses offer "free" technology? Do the Chinese importing units benefit from it? The answer is negative.

"Free" technology is offered in two cases. When we combine our import of certain equipment and its manufacturing technology, as we reach a specific quantity, the foreign business provides the technology at no cost. This is essentially a "gift." In the other case, the cost of the technology is included in the equipment. It appears that the technology is free. The majority belongs to the latter case. This is the subject of discussion of this article.

According to the Chinese tax code, a foreign business must pay a 20 percent income tax on the technology portion of the contract if it includes both technology and equipment. The foreign business has no liability on the equipment cost portion of the contract. Instead, the domestic business must pay import duty and unified business tax on that portion. It is not difficult to see the true color of the so-called "free" technology.

If the total cost of a contract is $1,000,000; $300,000 for the technology and $700,000 for the equipment, the foreign business, by law, must pay $60,000 of income tax. If the total cost of the contract remains the same and the technology cost is changed to 100,000 and equipment cost is raised to $900,000, then the tax burden of the foreign business is reduce to $20,000. The loophole is $40,000. If the entire contract cost is for equipment and technology is provided free of charge, then the foreign business can evade paying taxes completely (zero foreign business income tax). This is the essence of offering "free" technology.

In other situations, the cost of technology is reduced. Importing equipment becomes the prerequisite condition and the cost of equipment is raised. This is essentially the same as offering "free" technology.

By offering technology "free" or at a lower cost, not only the revenue of the Chinese government is reduced but also the burden of the importing unit is increased. The higher the equipment cost is, the more import tariff and business tax the operating unit must pay.

Hence, "free" technology definitely does not benefit importing organizations. On the contrary, they are the losers. The Chinese government also suffers loss of significant revenues.

Of course, it is not true that the software cost should be as high as possible. We must not interpret the import of a single machine as a technology import to pay royalty for its use.

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WUHAN'S TECHNOLOGY MARKET SITUATION REPORTED

Tianjin JISHU SHICHANG BAO in Chinese 30 Sep 86 p 1

[Article by Zou Jin [6760 6930] and Zhang Xiaohe [1728 1420 0735]: "Wuhan's Technology Market Flourishing"]

[Text] Since its founding last January, Wuhan's technology market has been active in serving research and production organizations to expand trade. Significant economic benefits have already been realized.

Centered around the goals of the Seventh 5-Year Plan to manufacture products, to catch up with the state of the art, to build a good foundation and to increase productivity, they took responsibility over technical and economic collaboration projects from the city economic commission and the city production technology bureau. In order to accelerate technological advancement and to improve the digestive capacity of the industry, they helped various authorities complete the coordination of 270 collaborative projects. Official agreements were signed for 212 projects. Seven of them were reached as a direct result of the technology market. Wuhan's technology market also secured 1,020,000 yuan as loans to technological projects from the Chinese government in 1986 and helped the bank review these projects. The technical and economic feasibility of 26 projects was proven on this basis. It set up rules such as "Interest Payment to Loans for Technology Projects" and "Temporary Method to Evaluate Project Technical and Economic Feasibility" to review new products.

Through various channel, Wuhan's technology market collects a wide range of technical information. They routinely visit universities in China, particularly universities and research institutes in the Wuhan area, to gather information on new accomplishments and then publish a monthly newsletter. Thus, such information is spread to the industries. The needs of various industries are also being fed back to the universities. They have an information network consisting of 96 contacts and have collected over 1,000 accomplishments from about 100 universities and research institutes. They also conducted more than 1,100 interviews. They registered 96 contracts for bids and organized several shows to promote accomplishments. Over 300 units were sold for nearly 10,000 yuan.

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CHANGES IN MANAGEMENT FOCUS DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 8, Aug 86 pp 33-35

[Article by Chen Qipei [7115 0366 0160], Suzhou Silk Institute: "A Discussion of Problems in the Transformation of Management States for Developmental Research Units"; first three paragraphs are source-supplied introduction]

[Text] Editor's note: With the continued development of the restructuring of the science and technology system, the restructuring of the allocation system has been implemented, and the problem of expenses autonomy has been seriously placed before developmental research units. Now is the time that developmental research units must consider this question of how we are to realize economic independence at the same time as we better cater to economic construction.

At present, some developmental research units have shown themselves to be rather incompetent during the restructuring of the science and technology system. They have not actively engaged themselves in the powerful currents of the restructuring, but have closed themselves up for so-called self-perfecting, so that with a few changes they would be complete. This method is no way out, and is extremely harmful. They could hardly realize that with the continued development of the restructuring, when they had reached "self-perfection" would be the day they had to close their doors for good.

Developmental research units should make the most of their strengths, should increase the pace at which they change their concepts, should find a position in the currents of the restructuring that will suit their own existence and development, and should continue to advance and open things up, making their rightful contributions to the drive toward the four modernizations.

In the process during which spending for operating expenses in developmental research units has been changing to a compensated contract system, there has been the temporary problem of "changes" in management states, that is, where solely administrative management has changed to operations management.

I. Two Different Concepts

Solely administrative management and operations management are two different states of science research management. By sole administrative management is

meant that research units do science research for the sake of science research, emphasizing the "production of achievements," but ignoring the dissemination and application of those achievements, and where the science research activities within the research units are closed to the outside. This sort of management will invariably force the appraisal of science research projects to become the final goal of science research efforts. Achievements are "pigeonholed," it is difficult to make the most of their economic benefits, and science research therefore lacks vitality. While in the case of operations management, it is not only managed in accordance with natural rules, but also in accordance with economic laws. The intention is to finish the process of science research, which is to include the dissemination and application of science research in the subject matter of science research efforts. There should be an emphasis on the transformation of achievements into production forces, an emphasis on the economic results of achievements, and science research activities within science research units should be closely bound to trends in professional and technical development. For a long time now, science research units have been managed by the solely administrative management method. They have not been in step with the requirements of economic construction, and changes to this kind of state of management have become imperative.

II. The Important Significance of "Changing Form"

"Changing form" for developmental research units is a necessity of circumstance. In the spirit of the working report by Premier Zhao Ziyang at the Second Session of the Sixth National People's Congress, within 3 to 5 years they should spread the compensated contract system to all science research units engaged in technology development and in dissemination and application. None of the research units implementing the compensated contract system can rely solely upon administrative methods to manage science and technology. If research units are to produce more achievements and more talent, and create more economic results, then under the prerequisite of first completing prescriptive science research tasking, they should actively undertake science research tasking as commissioned by all aspects of society; they must arrange for an income, and at the same time as they maintain their focus on science research, their income should gradually reach the point at which it is largely technically derived; they must manage science research efforts in accordance with the "two laws," and must maintain the principle of allocation according to labor, organically integrating the three factors of responsibility, authority, and benefit. Just think. If they were to follow the solely administrative management methods, only paying attention to "producing achievements" and not worrying about transforming the achievements into production forces, then whence would come the technically derived income? Also, if following the solely administrative management method, there would be a separation between activities within the research unit and economic construction. The selection of subjects for research would not be closely connected with trends in the development of production technology within a profession, so whence would come the economic results? Things of this nature have made us aware of a principle--if we are to implement the compensated contract system, we must restructure in terms of states of management.

III. Indications of "Changing Form"

The "changing of forms" for developmental research units is a thing that is currently undergoing development. Objectively, there will be indications of changes in the state of any thing. To allow the problem of "changing forms" to change from a realization in theory to one that is concrete, we believe that on the basis of the methods of some research units the "changing of forms" for locally applying technology research units should at least manifest the following indications:

First, changes in concept. By this is meant changes in the guiding ideology of management. The management of research units is changing from science research at its core to a focus on science research operations; the point of focus for science research efforts is not limited to "producing achievements," but is in going further to transform those achievements into production forces; the evaluation of science research achievements is going from a sole view toward advances in technology to a concurrent view of the economic reasonableness. Guiding ideology must have been rectified before "changing of forms" is possible. For this reason, changes in management thinking are the foremost and fundamental indications.

Second, organizational structures for management will change correspondingly. Based on their own directions and tasking for science research, research units will change from management structures that suit the solely scientific research process to a main body that suits the science research--operations process. There will be design and restructuring of management structures in the various links of project selection, the scientific research process, appraisal of achievements, and dissemination of achievements by organizing structures based on the actual needs of each science research unit. For example, they will establish scientific and technical consulting service departments, will establish sections for scientific research and development or sections for dissemination, and they will perfect reward systems. Changes in organizing structures are organizing guarantees and indications of the "changing of forms" for science research units.

Third, changes in the tasks and methods of management. The following new management tasks should be added:

1) Do a good job of managing science research achievements. Achievement management means changing potential production forces into real production forces, and joining together the internal activities of research units with trends in production technology developments of other professions. Regarding the methods for the dissemination and applications of achievements, in the past and the future that has focused on compensated transferral of rights. Because research units develop science research activities for technological advances in a particular industry, they must maintain their focus on science research and must achieve a dependence on technology derived income, and should not, nor can they, make excessive use themselves of science research achievements to arrange for production. 2) Include lateral technical services within the scope of science research management. Generally speaking, the technical capacity of research units is rather concentrated, instrumentation and equipment are rather advanced and complete, reference

materials are quite abundant, and the data at hand is also quite plentiful and quickly obtainable. Internal activities in solely administrative management were closed to the outside, parties thus concerned were unwilling to make full use of these advantages for social operations style management, to serve production, nor to increase economic results for themselves. An example could be where the Suzhou Silk Science Institute built up a science and technology consulting service department beginning at the end of 1983, and by the end of 1985 they had served 114 projects for factories, schools, and science research units from Jiangsu Province, the city of Suzhou, and other areas. They also earned more than 70,000 yuan in service fees, and although this amount of income cannot be considered large economically, the social results generated through the technical services was much greater than that. 3) Implement science research responsibility systems. Science research responsibility systems are science research management systems that organically integrate into one the three factors of responsibility to the state and higher levels, rightful authority, and rightful benefits, all three of which belong to science research units and organizations at all levels in their science research activities. The three positions of responsibility, authority, and benefits are considered as one entity, organically related, and with mutual interaction. Responsibility is a requirement of the state proposed to science research units, and ought to be hierarchically dispersed into departments and to individuals; authority is the assurance through which responsibility is accomplished; benefit is predicated upon responsibility. That is, benefits are determined by responsibility, and responsibility is also conditioned by authority, for responsibility without authority would be hard pressed to ensure quality or quantity, nor could it arouse enthusiasm. The science research responsibility systems are effective ways in which science research units arouse the enthusiasm of scientists and technicians, and by which they break up "egalitarianism" and "eating from the communal pot," are positive means by which they advance the improvement of science research management levels and the integration of science and technology with the economy, and are effective measures by which they promote the "changing of forms." There may be many forms taken by the science research responsibility systems, but at present there are commonly two forms: 1) project contract responsibility system; 2) a results-related reward system fixed to workpoints.

Speaking of management methods, if we are to change from traditional management to systems management we should progressively develop the six major areas of management for science research units--policy management, personnel management, planning management, conditions management, economic management, and academic management; if we are to change from empirical quantitative management to a management that combines the quantities and qualities of science, we should also gradually promote modern management methods. For example: by using technical and economic analyses and the methods of forecasting and decision making, this will provide a basis for the selection of science research topics. Topic selection is a kind of decision making, and if the decision making is accurate, this means one-half of a success. The famous scientist (BEI FU LI QI) once pointed out that "in scientific research or when undertaking science research decision making, to be crippled and yet not lose the way, one can surpass those who walk as if running, but who go astray." Using modern management methods will help us make the decisions that are more difficult to decide upon.

IV. We Should Pay Attention to Handling Several Different Relations

In the process by which developmental research units' management states change from purely administrative management to operations management, we should pay close attention to handling the following relations:

1. Handle well the relations between the production of achievements, the production of talent, and generation of greater economic results. The aims of science research units are to produce achievements, produce talent, and generate more economic results. Here, we want to note that the "production of achievements, the production of talent," and the "greater generation of economic results" are to be drawn together and not separated, for the "production of achievements and of talent" and the "greater generation of economic results" are complementary and cannot be prejudiced toward one aspect. This is especially true for the process by which research units management states change, where there is even greater need to prevent a tendency to simply seek economic results. We cannot go from only pursuing "production of achievements and talent" without seeking "economic results" to simply pursuing "economic results" while ignoring "production of achievements and talent."

2. Correctly handle the relations between the quantities and qualities of science research achievements. In the process of progressively implementing operations style management, we should watch for the appearance of a tendency to one-sidedly seek quantities of achievements while ignoring the quality of achievements. To hasten the dissemination and application of achievements, generally be willing to take on some projects where research time is short and achievement production is quick. Comparatively speaking, some projects of great difficulty, longer research times, and high levels of technology will be met with indifference. I believe that as far as science research units are concerned, the levels of science research are very important, and from the strategic point of view the two types of projects just mentioned should be maintained at a certain proportion. In this way, it will encourage scientists and technicians to take on long range projects, and some measures could be adopted from the area of rewards systems to improve the enthusiasm of scientists and technicians.

3. Correctly handle the relations between building material cultures and building spiritual cultures. In the upsurge of the restructuring of the science and technology system, we should go further in enhancing our ideological and political efforts, and should earnestly work toward the simultaneous achievement of the two cultures. As the management states of research units change, a new series of problems will appear, and for this reason, further exploration in the area of scientific research of how to advocate science research morality and how to take on the building of a spiritual culture may not be ignored.

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RESEARCH INTENSIVE INSTITUTES URGED TO SELF-SUFFICIENCY

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No, 8 Aug 86 pp 35-37

[Article by Gan Lin [3927 7207], Institute of the Petroleum Chemical Industry Hebei Province: "An Exploration of Self-support and Development for Technology Development Institutes"]

[Text] With the continued penetration and development of the restructuring of the science and technology system, technology development institutes will have to gradually abolish state supplied operating expenses within a 3-5-year period. How will institutes achieve economic independence? How will the transition be toward science research and production model enterprises? This series of major questions urgently awaits our study and consideration.

I. It will be hard for development institutes to be self-supporting by relying only on the transfer of rights to scientific and technical achievements.

A. There is always the possibility that science research will fail. Science research is an exploratory affair and has a certain risk about it, which is an objective law about science research; with the adjustment of state commodity pricing policies, or the large scale importation of new commodities, or even the successful development of certain projects, these things can be difficult to sell, which will directly affect the income of institutes; in addition, science research is also affected and restricted by national credit policies. At times this makes achievements very difficult to sell or forces a reduction in price. The success or failure of science research, the multitude of changes in the economic market, and the adjustment of financial policies--all of these things are hard to endure for research organizations for whom income is both little and unstable.

B. Science research is periodic and economic income from that is not stable. General developmental "short-term, appropriate-level, quick-result" projects at the least require about 1 year and can be as long as 3-4 years. During this period, some projects will be concurrent with the research phase, when economic income is at its least, and regular science research or daily expenditures will be difficult to maintain. Without stable economic reserves, institutes can find it hard to endure periodic passivity.

C. Local institutes have a poor foundation, their level of technology is low, the pricing of their achievements is low, and their income is small. Many local institutes have no testing areas, and invariably some small test results will force sales or they will be all over looking for enterprises to carry out testing, the fees for transfers of rights will be very low, the cost will be deducted, and the profit gained even smaller.

Before the restructuring of the system, each science research unit had certain technical reserves, and for the sake of economic independence research institutes competed to sell rights to technology and those technical reserves have become emptied, all sold away. From the latter half of 1985 to the present, there have been clear drops in economic income, so that operating expenses have been reduced 30-60 percent, and the economic situation for each institute has become quite tight.

D. Sole reliance on the sale of scientific and technical achievements is not in the spirit of the restructuring of the science and technology system. If developmental research structures put all their energies into laboratories, striving hard to produce more achievements and more patents, but are unwilling to expend more effort in the areas of production applications and in service of enterprise technology, thinking to improve their own levels of science research and to nurture science research by means of science research, then that would actually be placing themselves within ivory towers, taking once again the road of regression in which science research is divorced from production.

II. There is only one way for developmental research organizations to be self-supporting and to develop.

Developmental research organizations in developed countries generally belong to one company, enterprise, or group, and also directly serve that company. Their science research achievements and technology are all monopolized by it, improving by this means its own competitive capacity. There is little doubt that for this kind of organizational structure science research and production have an intimate life and death relationship. We cannot copy the western models, but based on the objective facts for the great majority of science research organizations situated outside of enterprises, we should encourage research organizations that are engaged in technology development to establish associations of various sorts with enterprises and design structures according to the principles of voluntary participation and mutual benefit. Some might gradually develop into economic entities; some could join together on the basis of association, enterprises could become part of research organizations, or research organizations could become part of enterprises. Some research organizations could go on to develop into science research and production enterprises or development structures of small to medium enterprise associations. This is the only way for technology development structures to development.

A. Actively develop associations between science research and production operations. Since the restructuring of the science and technology system, associations of various configurations have sprung up like bamboo shoots after

a rain. Facts have shown that this is one of the quickest and best methods at present in this country to join science research and production. No matter which way the association is formed, there are two basic forms.

1. The loose type. This is the initial stage for associations. The primary method is: science research units produce achievements as well as carry on technical service at irregular intervals; production enterprises provide areas for factories, come up with funds and equipment, and provide the manpower. Science research units generally deduct from 3 to 5 percent of 30 percent of net profits or volumes of sales. Science research units have no management authority for production, finances, or operations over this type of association. The problem at present is that in the beginning the enthusiasm of both parties is quite high, but after the enterprise has taken control of the technology, there are regular contradictions regarding the distribution of income with research units, which affects the enthusiasm of these associations. Many associations of this sort have taken shape, and for this reason are in urgent need of rectification and perfection.

2. The cohesive type. Or, call it the advanced type. In addition to providing technology, for this sort of association science research organizations also directly send people to participate in the production, operation, and financial management of enterprises. Some also provide a certain amount of money and share the risks, and both parties feel great responsibility. Actually, this kind of association has become an economic entity and has the possibility of developing itself into a science research and production enterprise, or into a technology development structure for small to medium-size enterprise associations, or into laying the foundation for enterprises to merge with research organizations.

B. Enterprises merge with research organizations or institutes develop their own laboratories. Through the cohesive association, some small enterprises will make the most of their results, will become aware of the benefits of science research, and will be very willing to directly merge with institutes. But because affiliation with departments can be stifling, jurisdiction relations cannot be resolved, and at present the opportunity is not yet right for small enterprises to directly merge with research institutes. With the continued development of the restructuring of the economic system and with the possession of true autonomy by enterprises, these problems will be readily solved.

Some qualified institutes can even run laboratories themselves. Some comrades are worried that if research organizations merge with enterprises, or run laboratories on their own, that will affect the development of science research. They are even more worried that excessively large self-run enterprises or excessively numerous cohesive-type associations will be unable to manage themselves, and in the end will consume themselves, or other concerns of this sort. These worries are not necessary for it has already been clearly pointed out among the resolutions concerning restructuring of the science and technology system that science research structures can merge with enterprises, and when enterprises have become large, if enterprises are allowed to combine with science research structures this, too, is a direction for development.

C. Research structures merge with enterprises. Through the cohesive association of science research and production, some large enterprises will certainly feel that science research units can serve their particular enterprise, that they could improve their own capacity for competition, and that they, too, have the capacity to absorb the technical capabilities of the science research units and can take on their financial expenditures. Under the principles of voluntary participation and mutual benefit, science research structures can then progressively merge with enterprises. This is an advanced form of mutual integration of science research with production, and is a tendency for development. However, some factories in this country concentrate on the manufacture of a single line of products, while for local institutes, their specialized equipment might be very comprehensive. There are still many problems for direct merger with enterprises. If a science research structure is heedlessly merged with an enterprise, this is bound to cause the break-up of a group of technology capabilities, science research equipment, and even the entire science research structure, all of which might have been building up over several years. The comprehensive nature of all levels of industrial companies in this country is quite strong and is capable of absorbing some local academies and institutes. But at present these companies are all administrative structures, not economic entities, and merging these companies would actually be a step backward.

Since the restructuring of the economic system, lateral economic associations have appeared. These lateral associations will constitute enterprise groups of different levels or enterprise blocs. They are multi-discipline, have a great degree of actual strength, have great capacity, and they act as vanguards for the restructuring of the science research system. If science research units will enthusiastically move toward participating in this kind of enterprise group or bloc, this will provide expanded territory for the development of science research.

III. Science research units should provide a production operations ideology as quickly as possible.

A. The transition to science research and production forms. Science research units should change their traditional thinking regarding sole engagement in science research. Getting involved in science research and production associations is also good, enterprises merging with science research structures or science research structures merging with enterprises is also all right, and so is the running of laboratories as part of the host organization. For all these things face up to a problem of production, and all intend to fundamentally and thoroughly change the old system in which there was engagement only in science research. Science research units must take the entire country into account and as quickly as possible establish a concept of production, of operations, of the marketplace, and of economic results, and should also take control of and improve these comprehensive management capabilities. Even if they undertake the transfer of rights to technology, it is not the case that each enterprise is simply buying an achievement. It is especially true that when local institutes are dealing with large town and township enterprises, they still need to continually improve their production and technical service, as well as pass on a certain amount of production

management knowledge. If a science research unit does not possess a certain capacity for production operations, all enterprises will also gradually become distant, and it will be difficult to remain stable and hold one's place. Currently, to evaluate the level of a science research organization, it is not enough to look solely at their science research, but there must instead be a full scale evaluation of the overall capabilities regarding science research, production, and operations.

B. Be of help to training and employing various types of personnel. Each research unit has a large number of technical personnel. Among these people, some are science research types, some are production types, and some are operations types. With the free integration of research topic groups, the integration of a certain group of personnel that should not be engaged in science research should not continue. Although these people cannot be scientists, they might be entrepreneurs. At present, science research organizations deeply feel a deficiency in operations management personnel, and these people could be allowed to run associations or to manage enterprises, which would make full use of the intelligence and talent of various types of people, and would find employment for various types of people.

C. Organize the development of associations of science research, design, and production operations to increase income over a broad range and to strive for early economic self-sufficiency. Many local institutes have no design capability and the transfer of rights to technology can only provide some project sketches and can only deal with some town and township enterprises. But medium to large enterprises demand that achievements undergo testing, that data be complete, and the results be obvious, and also that they be provided with an entire set of standard designs, so that the fees paid for transferring rights can be higher. Local institutes should make the most of their design capabilities and should take on some small design projects as appropriate so that this income can be increased. At the same time they will improve their own overall development capacity.

For some top quality products and series of developmental products, where economic results are high and the technical difficulty is great, they can initiate the organization of their own production, which will allow institutes to have a certain degree of economic income.

It is hard for the loose type of association to make good on results, and they should have the choice to change to the cohesive type, to allow the association to become one of the important financial sources for the institutes.

Research structures should actively participate in lateral associations. They should cater to society, to enterprises, and strive for technology development funds through multiple channels.

Science research structures nearly universally do not approve of the wording by which production guarantees science research and stimulates science research. When operating expenses were available in the past, in actuality this was dependence on the production of all of society to guarantee science research, and on the contrary, science research was even served by production.

Now, science research units are running associations and enterprises, one reason being to combine with production, and another as a source for expenses. It is just that at present it is a situation of everyone looking out for himself. As the trend to gradually get rid of state-supplied operating expenses moves inexorably on, science research units should establish an economic viewpoint, broaden their financial sources, and strive for early self-sufficiency.

Naturally, science research units will push for production operations to create even greater economic results, the goal here being to ensure science research, the enhancement of science research development capacity, and the promotion of the development of science research. If science research is neglected and let loose, things will turn upside down and that would be a great mistake. We must continue to overcome this sort of tendency.

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INSTITUTE, PRODUCTION ENTERPRISE MERGERS DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 8, Aug 86 p 37-39

[Article by Wang Jie [3769 2638] and Fang Xing [2455 5281], Changzhou Chemical Institute: "Developmental Institutes Should Integrate Science Research, Production, Foreign Trade, and Operations"]

[Text] The Changzhou Chemical Institute is a local institute that specializes in developing textile printing agents. Under the guidance of the slogan "Develop lateral associations, advance in the direction of research--production--operations," in 1985 all comrades throughout the institute stepped up their pace in developing new products that are textile printing agents. They vigorously opened up technology markets, and have stably and solidly continued overall perfection of the restructuring of the science and technology system. On the basis of our original restructuring, in 1985 our institute changed first of all the personnel system, implementing a graduated hiring system, which broke through the traditional cadre life-tenure system and allowed the personnel system to change and be linked with economic contract and responsibility systems and linked with a functionary system of personal responsibility. Implementing the hiring system can regulate in a timely manner the relations between leaders and those who are led. It can abolish internal strife, increase cohesion, promote the movement of personnel, and motivate staff enthusiasm. Regarding the science and technology system, strengthening applications research has impelled scientific and technical achievements to be shifted to production in the form of complete sets of software and hardware and has allowed scientific and technical achievements to be successful the first time, in the majority of cases, when sold into production. They have gone quickly into production and economic results have been outstanding. In the process of implementing the economic contracts and responsibility system, after 1 year of practice the institute sought for a certain amount of experience during the 2d year of contracts. Examination standards are more particular, and within the institute all examinable departments and places have signed contracts. Regarding allocation, in 1985 the institute also took control overall in accordance with policy, and with an offering of rewards of as much as could be spared by the institute, one-fourth of that over quota, allowed rewards throughout the institute to be the same as state profits. We thereby truly achieved concurrent regard to benefits of all three--the state, the group, and the individual.

To improve economic results and promote the commercialization and industrialization of science research achievements, this institute faced up to the level of people's expenditures and of the open-door policy, as well as to the needs of foreign trade and export, and products in the marketplace were continually renewed and replaced. Developments in the textile printing industry were especially quick, so demand for textile printing agents were correspondingly higher. To this end, this institute has begun in the 1980's to adjust the directions of science research, shifting progressively to the direction of a focus on scientific research on textile printing agents. Because the project selection has been on track, that is in close proximity to national economic construction, and the rates at which scientific and technical achievements have gone into production have improved substantially. To further enhance and develop the cooperative relations between this institute and production factories, to reduce the gaps between the development of textile printing agents and applications within production, and to hasten the shift of technology to production, this institute began in 1981, with the vigorous support of higher level departments, to establish separate science research and production associations with the Changzhou Reagent Factory and the Wujin County Daixi Laboratory and Chemical Plant, respectively, in accordance with the principle that the unit nature, affiliation relations, and financial channels will not change. The form taken by this association is a low-level form where the focus is on the transfer of the rights to scientific and technical achievements, and where after the new products developed by the institute has been transferred to the association factories, the factories concentrate on the management of production operations, and the institute assumes responsibility for the guidance of production technology and of supervision of production quality, providing as well technical services and related information; the factories will pay technical service fees to the institute in the amount of 2 percent of annual sales, and with transfer of the rights to a particular achievement, they will sign an agreement, and they will also carry out an exclusive accounting of that product twice yearly. The consequences of working this way are: there is concerted development of the production of textile dyeing agents in this city from the starting point of raw materials to the field of production. This allows the production factory technology to have its reserves, gives a stable improvement to product quality, adds marketplace competitive capability, and further reduces the time for science research to develop into production, and promotes the renewal and replacement of products. The level of production technology at these two factories has advanced continually, and at the same time a vitality has been added to the institute, which has improved economic results. After more than 3 years of experience for the associations in science research and production, even though the form of the associations is still rather primitive, the results have been obvious, and this has been an effective path for the shift of scientific and technical achievements into production.

In the latter half of 1984, this institute implemented a reform of the science and technology system and allowed further freedom of action, and the science research and production associations also further improved their original foundation. Our particular actions were:

1. Achievements were applied at and sold to reasonable domestic locations, and we did a good job with trans-provincial and city science research and production associations.

The transfer of rights to scientific and technical achievements and the dissemination of applications are the keys by which applying science research units obtain economic results. From the point of view of overall benefits, this has improved and expanded the area of coverage for our scientific and technical achievements and can provide even greater economic results for the state. Our institute has selectively set up technology showcases at textile centers within this country, and also have seen to the benefits of the purchasing party based on the capacity of the market. This has formulated the principle that rights to a particular achievement are not sold more than once within a radius of 1,000 km. In accordance with this principle, we have signed contracts for the transfer of rights to a technical achievement with some units in outlying areas. This institute has established a base area for the directional transfers of achievements. Our scientific and technical achievements can be directionally transferred to these locations, new products developed by this institute can be sold widely at various areas throughout the country after production by these associations. By working in this way, we can extend the area of coverage of these achievements, by which we can both increase economic income to the institute and, also, the social results will be even more outstanding.

2. There was a merging with the enterprises of this city to establish science research and production economic entities.

This year, our institute joined with the Changzhou Reagent Factory and the Wujin County Daixi Chemical Plant to form a science research and production economic entity, which allowed both factories to become laboratory factories for this institute, reducing even more the gaps between research and production.

Beginning in 1980, and in order to hasten the pace of shifting scientific and technical achievements to production, this institute has formed research and production associations in the Changzhou region with the Changzhou Reagent Factory, the Wujin County Daixi Chemical Plant, Jiangnan Reagent Plant, and the Light Industrial and Textile Supplementary Materials Plant for the transfer of rights for either a single or multiple achievements. However, because neither ownership, financial channels, nor jurisdictions changed, for this type of loose association there was only contact and separate economic dealings in the process of transferring rights to achievements, so neither party had either more authority or obligations. We had no way to take greater interest in the aspects of an enterprise's operations management, commodity directions, or technical reserves. We then ran into the following two situations: the first was that if the enterprise earnestly took on the responsibility for new products developed by this institute, if management was strict, if there were guarantees to quality, then it would quickly find a certain market and bring in better economic results; while the other situation was when the enterprise management base was deficient, discipline was lax, product quality control was not good, reputation among users was lost, and the achievement came to a premature end.

With the development of reform tendencies and the ever increasing fierceness of product competition in the marketplace, we also began to exert efforts to select one or two units within the original association enterprises for merging, to make up research and production economic entities, and to use science and technology to develop production. The Wujin County Daixi Chemical Plant is a township run chemical plant in which this institute had a hand in fostering in 1979. Leadership at the plant and in Daixi Township felt deeply that if they were to be separated from the institute there could be no development, and that even their existence would be threatened. To go further in seeking development, the plant took the initiative to request implementing a cohesive association with this institute. As far as our institute is concerned, after forming the association with Daixi Chemical Plant, the transfer of research achievements into production was quickened, for this is both a laboratory and plant, and is an expanded testing base for achievements. Economic results have steadily increased yearly, and have become one of this institute's fixed economic sources. Their cohesive association has developed from a "love" process. The Wujin Daixi Chemical Plant changed from being subordinate to the leadership of Daixi Township in Wujin County to being subordinate to the leadership of this institute. The plant changed its name to Laboratory Plant No 2 of the Changzhou Chemical Institute, and the plant director is selected through consultations jointly with the local government and this institute, and the deputy director and mid-level cadre are appointed by the plant director.

The Changzhou Reagent Plant is one of the major enterprises in the production of textile printing agents in Jiangsu Province and formed an association with this institute in 1982. We have already transferred the rights for five achievements to this plant, but although there have been results from this, they have not yet been outstanding. Plant development was slow, and for this reason the plant leadership and high level company leadership had pressed requests for merging with this institute. We also believe that the potential of this plant is quite large. The plant products and institute's research directions are in complete unity, and as long as there is a proper rectification of leading groups at all levels and good management of each link in product development and production operations, the plant can quickly take off. This being so, this institute took in the Changzhou Reagent Plant to form an economic entity of the research and production operations type. Ownership after the merger did not change, financial channels did not change, and the Changzhou Reagent Plant changed its affiliation from the plant company leadership to affiliation with the institute leadership. The factory hung out the sign of the Changzhou Chemical Institute Laboratory, the plant director is a concurrent position with institute director or deputy institute director, the deputy plant director or mid-level cadre are appointed by the plant director, and the plant administration, production, operations, and technology are guided by this institute.

After the merger of one institute with two factories to form an economic entity, the output values and profits for the two factories could quadruple to attain a pace of growth never before achieved. This kind of economic entity that uses science and technology as its reserves will exhibit in actual practice a strong, vigorous vitality.

3. This institute is a research organization centered on the development of new products in the line of textile printing agents, and aside from taking care of these vertically related cohesive associations in the research and production of textile printing agents, we have also made efforts at lateral associations that transcend particular industries. We run our own textile printing laboratory and factory, in which we make direct use of the agents we have developed on woven fabric, and have worked out quality special post-treatments for fabrics.

Last year, this institute joined with the local Chashan Cotton Fabric Factory to found the Chahua Industrial, Ltd., which first of all built a scouring and bleaching post-treatment production line with a 10 million meter capacity. We used the advantages of the Chashan Cotton Fabric Factory and the superiorities of the special treatment agents developed by this institute, and we used the scouring and bleaching post-treatment production line to link together the parts that had been joined. The second step was to increase the amount of textile printing equipment and to form a production line from the creation of the woven fabric to the textile-printing scouring and bleaching post-treatment, which allowed the new agents that we had developed to finally appear as products in the marketplace, and which also acted as an applications testing base for the textile printing agents developed by the institute.

4. We actively opened up foreign trade of new products in textile printing agents.

Opening up the foreign trade of new products in textile printing agents is an important path by which to develop the production of these agents, and moreover can change the passive situation in which there are only imports of textile printing agents and exports, and can bring about a new upswing.

At present, we have already signed a letter of intention with the Ministry of the Chemical Industry's China Chemical Company, Ltd., located in Shenzhen, where under the name of the China Chemical Company, Ltd., we will strive to generate foreign exchange through exports abroad. Recently, the (SI TUO KE HE XIN) Company of West Germany has expressed to us their strong interest in buying our CAS anti-static agent, the FZ (SHU SHI) hydrophilic collating agent, the ZR and ZL electrostatic flocking bonding agents, and SHW coating printing bonding agent, and we have sent samples to this company.

Our plans are to allow export trade of agents gradually constitute 5 to 10 percent of total sales volume.

Through the several methods of domestic showcasing, factory-institute merging, lateral associations, and opening up foreign exports, we can then make the most of the superiorities of science research and production, operations, and foreign trade associations to become one base area for domestic research, development, and production of textile printing agents, one of the centers for information on textile printing agents, and one of the theoretical chemistry measuring and testing centers, all to make greater contributions to our nation.

We believe that the cohesive associations of research and production can improve the development capacities and contingency capabilities of enterprises, even quickly changing the situation regarding production operations of enterprises. First of all is the strengthening of the new product development capacity of enterprises, where the assistant chief engineer in the institute and lab director are each sent to the two factories and the Chahua Company to be chief engineers, where using the technical capacities of the lab as reserves they join up with enterprises to carry on new product development, each year putting new products into production, which activity meet the requirements of competition and continuous development; second, research units have acted as reserves, so the confidence of users has increased, which has been of use to the enhancement of the operations capacity of the enterprises, and channels have been opened for the provision of raw materials and sales networks have continued to expand. Recently, these entities of ours together convened a 1986 product ordering conference, the great effects and good results of which have been obvious; third, the research and production cohesive associations are well informed about product technology information, where each kind of information is exchanged among the parties, allowing enterprises to be well aware of the pulse of developments in their industry, which aids timely planning of the development directions for products and the opening up of new production fields; cohesive associations for research and production have also been of use in improving the management quality of enterprises and the technical quality of the staffs. As far as our institute itself is concerned, aside from being able to steadily improve economic income, we can also greatly hasten the progress of research projects from small-scale testing to medium-scale testing, improve the rate at which research achievements are placed into production, and promote the redevelopment of the research vocation.

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EFFECTS OF HIRING SYSTEM REFORM ON PERSONNEL DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 8, Aug 86 p 40

[Article by Gan Tongshan [3927 0681 1472], Office of Science and Technology Cadre, Tianmen County, Hubei Province: "The Significance of Implementing A Hiring System for Specialist and Technical Duties"]

[Text] Implementing a hiring system for specialist and technical duties is a major reform in the specialist and technical personnel management system of this country. It is an important component of the restructuring of the science and technology system, and is a fundamental effort concerning the cause of socialist modernization.

Implementing a hiring system for specialist and technical duties is the very best program among current activities in this country to reform the evaluation of positions, and its significance may be generalized as follows:

1. In implementing a hiring system for specialist and technical duties, it will be the first time that the responsibilities, authority, and benefits of specialist personnel will have been brought closely together.

At the core of the "Resolution by the CPC Central Committee Regarding Restructuring of the Economic System" is that we want to correctly handle the close integration of the relations, assigned responsibilities, authority, and benefits between the state, enterprises, and workers. Implementing a hiring system for specialist and technical duties means to establish positions for special technical duties in accordance with actual needs and to make provisions for the duties and responsibilities of each position, after which qualified specialized personnel hired by administrative leadership will assume their responsibilities. During the period of their employment, and aside from taking on responsibilities, specialists will share corresponding authority, and they will draw the wages for specialist and technical duties. Outside the period of their employment, responsibilities are withdrawn, as are their authority and remuneration, and this thus changes the situation of the past in which "people ate from the common pot," and it closely draws together the responsibilities, authority, and benefits of specialist personnel.

2. Implementing a hiring system for specialist and technical duties will be advantageous to promoting the rational movement of personnel.

In implementing a hiring system for specialist and technical duties, there will be a distinct proportion between the quantities of administrative personnel and specialists in any department or unit. Among specialist personnel, there will also be a certain compositional proportion of those of different categories and levels. It will be especially true that each profession in departments and units will establish a certain quota for positions of specialist and technical duties. This quota will not be decided blindly, but will be determined according to the varied situations regarding the scales of the particular departments or units and the economy. Therefore, for some departments and units that have concentrations of specialists and are overstaffed, there is the situation in which "there are not enough chairs for the people," and a certain portion of specialist personnel cannot be hired. What are these people going to do? It was pointed out in the State Council's "Resolution Regarding Implementation of a Hiring System for Specialist and Technical Duties" (hereafter, just "the Resolution") that for those people who could not assume special duties because of filled quotas within a particular department or unit, they should be encouraged and supported in going to other departments or units for employment. In this way, those awaiting employment will quite naturally be employed in those departments or units where "seats exceed the number of people." By truly overcoming the maladies of overstaffing and wasting of talent that have long existed within the management system for specialist and technical personnel, and by breaking up the situation whereby talent was confined and there was an expanse of stagnant water, we will promote the rational movement of personnel.

3. Implementing a hiring system for specialist and technical duties will benefit the reform in this country of the cadre system and the wage system.

It has been pointed out in the "Resolution" that "neither employment nor appointments for specialist and technical duties are forever. There should be a fixed time where each period of employment would not generally exceed 5 years. If the work requires it, the employment or appointment could be extended." This then clarifies that specialist and technical duties are not held forever. When specialists have the qualifications they are then employed, and when after employment they are the ones who can better fulfill the responsibilities of their jobs, then they can be extended in their employment or appointment. Otherwise, employment will not be offered or after employment the appointment will be terminated. The limits to employment will also be stipulated, which will fundamentally get rid of the lifetime employment in the science and technology cadre management system, and will break up the "iron ricebowl," allowing specialists to have their abilities, be in their positions, assume their responsibilities, and have their benefits.

The way in which the reform will benefit the wage system is chiefly in that in implementing a structured wage system, the duty wages for administrative cadre will be issued taking the administrative duties of section chiefs, office heads, and county magistrates as a basis. The duty wages for specialists will be issued in accordance with the technical duties of technicians, assistant engineers, engineers, and high-level engineers, by which will be effected a

consistent equivalency over the responsibilities, authority, and benefits of those with administrative duties and technical duties.

4. Implementing a hiring system for specialist and technical duties is the best way in which to resolve remaining problems from past post and rank evaluations.

It is stated in the "Resolution" that "for those who have gained posts and ranks in the past, we should in principle acknowledge the situation in which they are prepared to assume relevant specialist and technical duties. Appropriate arrangements should be made for qualified personnel in specialist and technical posts, and in accordance with needs, they should be given responsibilities for appropriate specialist and technical duties. Those among them who are less qualified should be helped to raise their performance as quickly as possible, and those who are completely unqualified cannot be allowed to take on the responsibilities for specialist and technical duties." For these reasons, competent personnel who obtained their positions in the past should be employed, while those who are incompetent but have obtained positions in the past should not be employed. Although they are already comfortably in position, this means nothing. In this way, we will both affirm the accomplishments of position evaluations in the past and also deny improper status from past position evaluations, and we will appropriately handle the major problems remaining from past position evaluations.

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IMPORT STRATEGIES IN GUANGZHOU OUTLINED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 8, Aug 86 p 49

[Article extracted from KEJI XINXI 1985 No 8, by Li Yang [2621 2254]: "Ten Ways in Which Guangzhou Imports Technology"]

[Text] 1. Technology is imported at the same time that equipment is, and rights are then transferred within and outside of the city.

2. After absorption, assimilation, and innovation of the imported technology, disseminate it to the interior.

3. Place imported technology back on the international market after innovating and improving it.

4. Import primary pieces of technology, research its auxiliary technology and transfer the auxiliary technology to the interior.

5. Focus research on technology, packaging with technology, and on foreign equipment packaged with it, which provides the interior with bundled products.

6. Foreign products are sold to locations in the interior.

7. Import technology and equipment along with management technologies.

8. Run scientific and technical consulting service enterprises cooperatively with foreign capital.

9. Make use of foreign capital to cooperatively train scientists and technicians.

10. Offer employment to foreign technical personnel and advisers, implementing the importation of talent and intellect.

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IMPROVEMENTS NOTED IN INDIGENIZATION OF IMPORTS

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT S&T] in Chinese No 8, Aug 86 p 49

[Article excerpted from JIEFANG RIBAO 7 Jan 1986 by Guang Li [1639 7152]: "The Degree of Indigenization of Shanghai Import Items Improves"]

[Text] Shanghai has improved the degree of indigenization of the importation of technology, which is characterized in the following ways:

First, the great majority of technology import items closely centers on carrying out a transformation of the technology structures and commodity structures of traditional enterprises.

Second, spurring on the indigenization of imported key equipment, components, and devices, as well as critical materials, with the final product determining the direction.

Third, by combining imported technology with domestic development efforts, this effectively promotes indigenization.

Fourth, it develops entire industries, as well as technological cooperation that transcends industries and regions to form a strong technical problem solving force.

Shanghai has accomplished much regarding the indigenization of imported foreign technology, but there are still problems remaining in promoting indigenization efforts: one is that technology importation efforts lack the guidance of industrial development planning; a second is that technology importation structures and technology absorption and assimilation are imperfect, uncoordinated, and have not formed structures of authority that are under unified direction; a third is that there is a lack of funds for the absorption and assimilation of technology, which even leads to a deadlock in the resolution of many key problems in technology. Aside from this, the many directions in importing, duplicate importing, and blind importing, as well as single-handed importing, have all created great deficiencies in raw materials and sets of components, which has also been a factor in difficulties with promoting indigenization.

The standpoint of this country in our modernization is that we are to act independently and on our own initiative, and that we be self-reliant. Importation is simply a means, and importing foreign technology is to strengthen our capacity for self-reliance. All viewpoints that stress importation while ignoring indigenization, all viewpoints that compete to import without regard to an overall view, and all viewpoints that take foreign exchange lightly while seeing the generation of it as a "soft task" are one-sided.

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BRIEFS

SHANGHAI'S ROLE AS MAJOR SPACE S&T BASE--Among the 18 satellites launched since the liberation of this country, 9 have been designed, manufactured, and launched with the participation of Shanghai, and 6 among them were launched by Shanghai alone. This indicates that Shanghai has become an important research and production base for tactical weapons and space technologies that are quite similar and rather complete regarding the match ups of specialties. This was learned at the 10 September conference celebrating the 30th anniversary of the founding of the space mission and the 25th anniversary of the creation of the aerospace industrial base in Shanghai. The Shanghai aerospace industrial base once united all relevant units, and using a rocket, simultaneously launched three satellites of differing purposes for the detection of space objects, which consequently allowed this country to become one of the few countries in the world to be in command of the technology for "one rocket, multiple satellites." The "Long March No 3" carrier rocket in which they participated in the development of, has successfully launched this country's first communications satellite in stationary orbit and satellites for use in communications and broadcasting. The successful launch of the broadcast communications satellite indicates that the space technology of this country has made major new breakthroughs, and has already taken its place within the world's advanced ranks. [By Zhang Yifu [1728 6318 1788] and Xiao Lian [2556 5571]] [Text] [Beijing GUANGMING RIBAO in Chinese 12 Sep 86 p 1] 12586

BAOSHAN COLD ROLLING MACHINE DELIVERY--It was learned in the recently held press conference on Baoshan's second phase of equipment buildup that, with regard to the Chinese effort in the joint production of three major pieces of equipment with Japan and the Federal Republic of Germany, the Model 2030 cold rolling machine has passed its most critical stage and its delivery by November this year is essentially assured. Technical preparation work for Model 2050 hot rolling machine is completed. It will be in production soon. Preparation for the production of Model 1900 sheet extruding machine is underway and will be ready by the end of the year. It is more challenging to make the Model 2050 hot rolling machine than the Model 2030 cold rolling machine. The production cycle is also shorter. However, due to the experience gained with 2030, particularly the management system of (Ximake) Company of Federal Republic of Germany, a lot of time has been saved. The Second Heavy Machinery Plant, which is responsible for the bulk of the task, has completed 95 percent of the preparation. 65 percent of the forged components have been made. It is expected to be completed by the end of September. Six planks are being cold worked. Assistant Minister of Machine Building Industry Zhao Minsheng [6392 3046 3932] attended this equipment press conference and summarized the progress. A vice president of (Ximake) also present at the meeting. [Text] [Beijing ZHONGGUO JIXIE BAO in Chinese 23 Sep86 p 1] 12553

NEW NUMERICALLY-CONTROLLED MACHINE TOOL--A new numerically controlled device suitable for the manufacturing of complicated parts on a machine tool has recently been successfully developed jointly by Tianjin Institute of Electronic Instrument and Tianjin Second Electronic Instrument Plant. This microprocessor numerical controller is based on programs written in standard digital control commands. it is suited for the technological reform of conventional machine tools. With the digital control device, a machine tool can be used to make complicated parts which are difficult to fabricate manually. It can make single and multiple threads, as well as conical threads. It can expand the processing capability of conventional machine tools and improve efficiency by four- to fivefold. [Text] [Tianjin JISHU SHICHANG BAO in Chinese 30 Sep 86 p 4] 12553

REMOTE SENSING BREAKTHROUGH--For the first time, China has made use of remote sensing equipment aboard satellites and aircraft to make comprehensive observations of the loess plateau's natural resources and the extent of erosion. The high-altitude observations have provided information on the geomorphology, land use, and natural resources of the loess plateau that is extremely accurate and reliable. It has provided important data for economic development and for the management of soil erosion. [Text] [Harbin HEILONGJIANG RIBAO in Chinese 4 Nov 86 p 1] /7358

CSO: 4008/23

ION BEAM LABORATORY, SHANGHAI INSTITUTE OF METALLURGY DESCRIBED

Beijing WULI [PHYSICS] in Chinese Vol 15, No 5, May 86 p 268

[Article by Liu Xianghuai [2692 5980 2037]]

[Text] Ion beam technology is a newly developed interdisciplinary field with a strong orientation toward applications. It is closely related to materials science, microelectronics, nuclear technology, and surface science, and finds broad applications in the materials and energy industries.

The Ion Beam Laboratory in the Shanghai Institute of Metallurgy, Chinese Academy of Sciences, is one of the first units to begin ion beam research. In the last 10 years or so, research results have been obtained in ion beam solid interaction, material modification, ion beam machining, and surface analysis. Some of the research results have reached the plant level and used in production. The work of the Ion Beam Laboratory has played a promoting role in China's ion beam technology development. In the last 10 years the laboratory has published 150 papers, with 70 of them appeared in foreign journals and proceedings of international conferences. Technologies and applications developed by the laboratory include semiconductor ion injection, high frequency and magnetically controlled sputtering, laser annealing of semiconductors with ion injection, SOI recrystallization of polycrystalline silicon with laser irradiation, ion beam etching and reacting ion beam etching, dual directional ion channeling and blocking, and metallic material modification by ion injection. Since 1974 the laboratory has collaborated with scholars from China and abroad. In China, the laboratory has cooperated with the Shanghai Institute of Nuclear Research, Chinese Academy of Sciences, for 10 years and joint developed China's first ion backscatter analysis technology. Together with the Shanghai Institute of Optics Fine Mechanics, Chinese Academy of Sciences, the Ion Beam Laboratory established the Laser Application Laboratory and initiated the research on laser annealing. In addition, they have also collaborated with the Shanghai University of Science and Technology and other research units and plants. In the area of international cooperation, Denmark scientist B.I. Deutch visited and worked at the laboratory in 1974, Dr Biersack of the Hamburg Nuclear Physics Institute in West Germany visited the laboratory for half a month in 1983, Professor Amsel of the University of Paris worked at the laboratory for 2 weeks in 1984, and, in the last 2 years Mr Zhu Weigan [2612 0787 1626], a well known professor from the University of North Carolina,

twice visited the laboratory. Professor Zhu has now been appointed deputy director of the Ion Beam Laboratory in the Shanghai Institute of Metallurgy. In addition, famous experts including J.W. Mayer of the United States, S. Namba of Japan, E. Rimini of Italy, and Carte of Great Britain have all led delegations and visited the Shanghai Institute of Metallurgy and conducted academic exchanges with the Ion Beam Laboratory.

The laboratory is now equipped with ion beam facilities covering both the low energy and the high energy regimes. A 2MeV tandem accelerator is now operating. The first ion beam machine built by the laboratory has now been successfully modified. Ion etching, reacting ion beam etching, high frequency sputtering, and magnetically controlled sputtering are now being used in ion beam machining and thin film growth. In addition, an external impedance measurement system has been acquired and a metallic ion injection machine will also be acquired.

In the next few years, priority projects in the laboratory include: 1) Interaction of ion beam and solids; 2) Monte Carlo simulation of range, surface analysis, ion beam mixing, and sputtering; 3) modification of silicon properties by ion injection and development of associated devices; 4) modification of GaAs and InP and device development; 5) metal modification by ion beam and its industrial applications; 6) semiconductor material modifications by ion beam; 7) SOI materials and devices; 8) transient annealing of ion injection layer in semiconductors and recrystallization; 9) ion channeling and backscatter analysis technology and applications in surface analysis of semiconductors and other materials; 10) bidirectional technology and application; 11) ion beam etching and reacting ion beam etching and their applications in micromachining of semiconductors and other materials; 12) reacting ion beam etching deposition, high frequency sputtering, magnetic sputtering and thin film growth.

The Ion Beam Laboratory of the Shanghai Institute of Metallurgy, Chinese Academy of Sciences, welcomes submission of proposals on the above topics by Chinese and foreign scientists. The proposals will be evaluated by the Academic Committee of the Ion Beam Open Laboratory. Qualified projects will receive total or partial funding from the Ion Beam Open Laboratory. Research projects with funding may also be brought in for joint research.

9698/6091
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LABORATORY OF INFRARED PHYSICS, SHANGHAI INSTITUTE OF TECHNICAL PHYSICS

Beijing WULI [PHYSICS] in Chinese Vol 15, No 5, May 86 p 294

[Article by Tang Wenguo [0781 2429 0948] and Kong Fanping [1313 0416 1627]]

[Text] The Shanghai Institute of Technical Physics, Chinese Academy of Sciences, was established in 1958. Since 1964, the main area of research at the institute has been infrared physics and technology. In recent years, 30 basic research projects have been completed and 40 some papers were published, with seven of them reported at international conferences. Research results on the absorption spectrum and phonon spectrum of $Cd_xHg_{1-x}Te$, low frequency phonon spectrum of $Cd_{1-x}Mn_xTe$, and infrared and far infrared spectral studies of amorphous silicon have attracted the attention of scientists in China and abroad. Important results have also been obtained in the investigation of galvanomagnetic effects and magnetoresistance oscillations in InSb and $Cd_xHg_{1-x}Te$, the zero bandgap phenomenon and pressure effects in $Cd_xHg_{1-x}Te$, the absorption edge pressure drift in CdMnTe, the reflection spectrum of field modulation in HgCdTe and PbSnTe, and the emission spectrum of CdTe.

The Infrared Physics Laboratory of the institute has been concentrating on the interaction of infrared radiation with matters and optoelectronics. Its current research topics include narrow bandgap semiconductor physics and other physical applications of infrared technology, far infrared properties of solids, optoelectric energy conversion and signal propagation process, infrared and far infrared spectral techniques, and far infrared physics and applications. These investigations will provide the scientific basis for the infrared technology and the new area of optoelectronics and help to develop the interdisciplinary field of infrared and far infrared.

The priority projects of the last 3 years in the laboratory include:

1) Physical problems of ternary narrow bandgap semiconductors (such as $Cd_xHg_{1-x}Te$), magnetic semiconductors, and other materials with potential optoelectronic applications (ferroelectrics and low loss polymers);
2) elementary excitation physics and optoelectric conversion processes of low energy electronic states and phonon states in solids; 3) interference spectrum and physical problems of infrared and far infrared; 4) electronic

states, infrared optics and optoelectronics of disordered solids, thin films and low dimensional solids; 5) electrical and magnetic properties, resonance phenomena and infrared properties of solids in strong magnetic field, at low temperatures, and under high pressures; 6) cross-disciplinary topics of infrared physics and other fields.

The Infrared Physics Laboratory has established setups for infrared and far infrared spectral measurements and research apparatus for transport property studies of semiconductors in low temperature and high magnetic field. The facility is unique in combining extreme experimental conditions with the study of far infrared spectrum and semiconductor transport properties. Major equipments include a visible-near infrared grating spectrophotometer (Bechman 5270), a mid-infrared grating spectrometer (Perkin-Elmer 983), a a Fourier transform spectrometer (Nicolet 200-SX), a Raman spectrometer (Spex 1403 high resolution triple monochromator and coherent 90 Ar^+ laser), a fluorescence spectrum apparatus (J-Y HRS-2), a semiconductor transport property apparatus (2T magnet and 10T superconducting magnet), and a high pressure setup (100 kbar diamond anvil and a 20 kbar dipole nonmagnetic high pressure apparatus). In addition, the laboratory is also equipped with SEM, ion injection and molecular epitaxy apparatus (supplied with liquid nitrogen and liquid helium), and has an optics shop for fabricating non-spherical optics components, and a general machine shop. The Infrared Physics Laboratory also provides its research facilities to researchers in China to conduct investigations.

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DYNAMIC HIGH PRESSURE TECHNOLOGY PRESENTED

Beijing WULI [PHYSICS] in Chinese Vol 15, No 5, May 86 pp 305-310

[Article by Jing Fuqian [4842 4395 6197] of the Beijing Industrial College]

[Text] Due to the limitation of material strength, high pressure produced by static methods[1] has long been limited to 200-300 kbar, and only in recent years have 2 Mbar pressure devices become available. The pressure in the core of the earth is about 3.6 Mbar, and the pressure at the center of the sun is about 1.5×10^5 Mbar. The range of pressure that can be generated statically for material property studies is therefore rather limited. For the purpose of material behavior investigation under high pressures, dynamic high-pressure techniques[2] have been developed since the 1940's. Using the dynamic technique, 70 Mbar of pressure may now be generated.[3] In the dynamic method, the action of the external force is gradually imparted to the entire object via wave propagation, the pressure on an element of the body is achieved through its inertia. In principle, the pressure can be increased infinitely by the dynamic technique as long as the pressure source is effective. Also, since the propagation speed is fast--usually several thousand meters per second in a solid--the heating effect produced by the mechanical work does not have sufficient time to exchange heat with the surrounding material and the compression process is adiabatic.

The $p = p(v)$ relationship of all materials are nonlinear at high pressure and, for most materials, $(\partial^2 p/\partial v^2)_s > 0$. Here, p is the pressure, v is the specific volume, and s is entropy. Equivalently,

$$\left[\frac{\partial^2(u+c)}{\partial p}\right]_s > 0 ,$$

with u being the particle velocity and c the speed of sound. The inequality above states that the velocity of a high-pressure element (u + c) is greater than the velocity of a low-pressure element. In the loading process, the wavefronts, due to the various pressure pulses, "pile up" and eventually form a steep wavefront as shown in Figure 1. This is known as the shock wave and the compression due to the shock wave is known as shock compression.

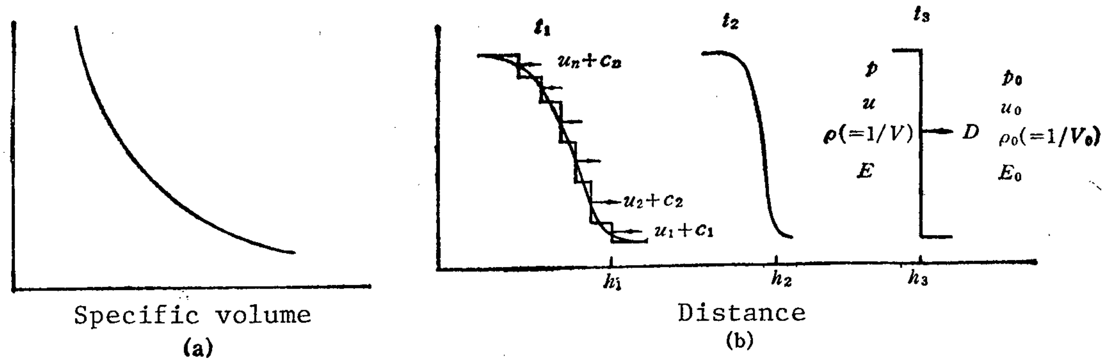

Figure 1. Formation and Evolution of the Shock Wave

(a) p-v curve with $(\partial^2 p/\partial v^2)>0$; (b) Evolution of the shock wave in the test piece (t is the time, $t_1 < t_2 < t_3$; h is the position in the test piece, $h_1 < h_2 < h_3$)

There are three techniques for producing the high pressure of a shock wave: 1) the contact explosion method, 2) the high-speed flier impact method, and 3) the rapid energy deposition method.

In a narrow sense, dynamic high-pressure technique refers to the shock wave high-pressure technique. But in the broad sense, dynamic high technique refers to the compression of the test piece before the formation of the shock wave wavefront (see Figure 1). Since the entropy increase in this process is small, it is also called the isentropic compression technique.

I. Contact Explosion Method

Any chemical or physical reaction that releases a large amount of energy very rapidly may be called an explosion. The direct interaction of the high temperature, high pressure, and large density of the explosion products produced in an explosion exerts a great shock force on the surrounding medium (test piece).

TNT is a commonly used chemical explosive. The chemical reaction of TNT completes within 0.1 μs and releases 10^3 kcal/kg of energy. TNT is therefore an energy source for producing shock waves. Figure 2 is a typical contact explosion device.

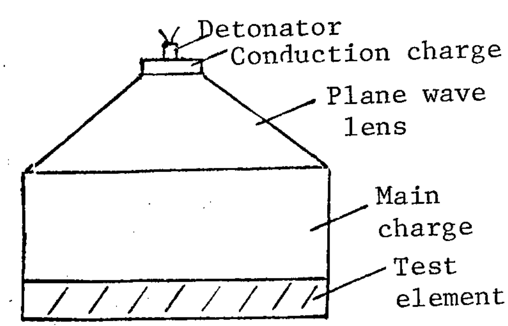

Figure 2. Schematic Diagram of a Chemical Explosion Contact Device

The plane wave generation is a device that converts a diverging detonation wave (a shock wave accompanied by a chemical reaction) to a plane detonation wave. The plane detonation wave from the plane wave generation detonates the main charge. The plane detonation wave propagating in the main charge collides with the test piece, imparts a shock wave to it, and compresses it. The shock pressure depends on the type of main charge and the shock impedance ~~of the test piece material (the shock impedance is defined as the initial~~ density of the material and the velocity of the shock wave). Using the contact chemical explosion method, the upper limit of the shock pressure in metallic materials is usually no more than 800 kbar.

Nuclear explosives consisting of fission or fusion materials are much more powerful than chemical explosives. For example, the energy released by a unit of fission material is about 10^7 times that of a chemical explosive and the rate of energy release is also much faster, capable of producing even higher shock pressures. In an underground nuclear explosion, the released energy causes the gas products to fill the entire explosion chamber very quickly and an isothermal sphere with an approximately uniform pressure is quickly formed. At this time, the internal energy and the pressure in the chamber may be written as[5]

$$E = \frac{3}{2} nkT + \frac{4\sigma T^4}{c},$$

$$p = nKT + \frac{1}{3}\frac{4\sigma T^4}{c},$$

where the first terms on the right-hand sides of the two equations represent respectively the material energy and the material pressure and the second terms represent respectively the radiation energy and the radiation pressure. In the above equations, n is the number of particles per unit volume in the chamber (equal to $A\rho/\mu$, with A being the Avogadro's number, μ being the average molecular weight of the material in the chamber, and ρ being the average density), k is Boltzmann's constant, T is temperature and σ is the Stefan-Boltzmann constant. The pressure on the explosion chamber wall predicted by the above two equations is very large indeed. For a 1m radius explosion chamber with a 1t nuclear device, the pressure on the wall may reach 12-524 Mbar if the nuclear explosion equivalence is 3-237 kt TNT. Naturally, to avoid the strong nuclear radiation and electromagnetic interference in a nuclear explosion, the test piece is usually placed at a distance of 1-2 m from the explosion chamber wall. The pressure on the test piece is much lower than that on the chamber wall because the pressure attenuates according to the inverse square law.

II. High-Speed Flier Impact Method

When a stationary target (test piece) is hit by a fast moving plate (flier), a shock wave is generated in the target and the target (test piece) is compressed. For a given target material, the work done on the target depends on the kinetic energy $\frac{1}{2}MW^2$ of the flier (here, M is the mass and W is the velocity of the flier). The shock pressure on the impact surface is therefore $p \sim \rho_0 W^2$. The pressure at the interface is roughly proportional to the

initial density ρ_0 of the flier and the square of the flier velocity W. To achieve a strong shock compression, the initial density and the velocity of the flier should be as large as possible.

Based on the energy source, there are five major flier acceleration devices: chemical explosion driven, high-pressure gas gun driven, electrically driven, electromagnetically driven, and nuclear explosion driven.

Figure 3 shows schematically the flier acceleration device using explosives. Under the propulsion of the detonation products, the flier makes a few centimeters of flight in the empty cavity to gain the energy provided by the explosion and to achieve a certain velocity.

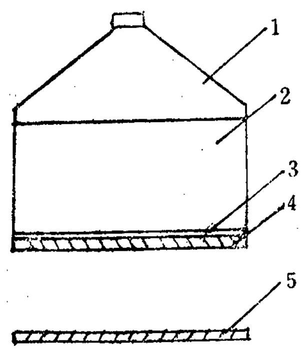

Figure 3. Schematic Diagram for Chemical Explosion Driven Flier Device

1--Plane wave generator; 2--Main charge; 3--Plastic plate or air gap; 4--Flier; 5--Target (test piece)

The acceleration of the flier in the empty cavity is achieved by the waves reflected back and forth in the flier. The waves transfer the energy absorbed by the back side of the flier to the front side to accelerate the flier and then return to the back side to absorb more energy and the process repeats. Through multiple reflections, the flier continues to absorb energy from the detonation products and finally reaches its limiting velocity. It takes a finite length of time for the flier to reach its limiting velocity and the empty cavity must therefore have a certain length. Generally the empty cavity is 5 cm long. The limiting velocity of the flier W_{max} is given by

$$\frac{W_{max}}{D} = 1 + \frac{1}{\eta} - \sqrt{\frac{2}{\eta} + \frac{1}{\eta^2}},$$

where D is the velocity of the detonation wave and $\eta = \frac{16}{27}\frac{m}{M}$. (m is the mass of the explosive and M is the mass of the flier). By changing the loading structure of the charge (the type of explosive, the flier material and the geometric layout of the entire device), the flier velocity may be varied from a few hundred meters per second to more than 10,000 meters per second. The shock pressure obtained by this method is generally three times that

obtained by chemical explosives. This may be raised to five times by using special loading structures.

The flier device that uses high-pressure compressed gas is called a high-pressure gas gun. It consists of a high-pressure chamber, a membrane, and a launch tube. Figure 4 shows the construction of a gas gun schematically. In an experiment the high-pressure chamber is first charged with gas; at a predetermined pressure, the membrane ruptures and the high-pressure gas rushes into the launch tube. The gas propels the projectile forward, with the flier attached on the tip of the projectile, and the flier collides with the test piece positioned a short distance from the muzzle.

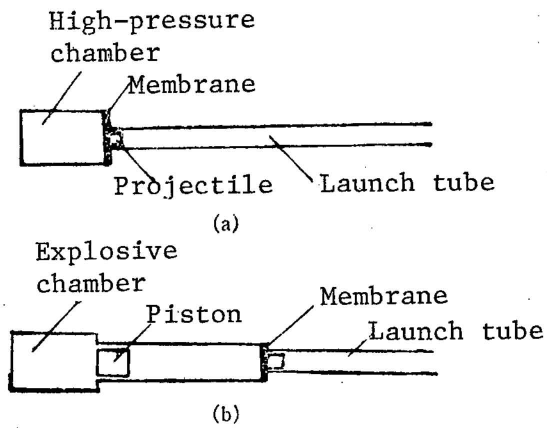

Figure 4. Schematic Diagram of the High-Pressure Gas Gun

(a) A single-stage gun; (b) A two-stage gun

The gas medium is usually air, nitrogen, helium, or hydrogen gas. The gas pressure and the projectile velocity may be related approximately as follows

$$\frac{p}{p_0} = \left(1 + \frac{\gamma - 1}{2}\frac{u}{c_0}\right)^{\frac{2\gamma}{(\gamma-1)}},$$

$$C_0 = \sqrt{\frac{\gamma R T_0}{\mu}},$$

where C_0 is the initial speed of sound in the gas, R is the gas constant, μ is the molecular weight, γ is the adiabatic constant of the gas, and T_0 is the initial temperature. These equations show that the projectile velocity is higher when the molecular weight is small, the speed of sound is large, and the temperature is high. The projectile velocity of a single-stage gun is usually several tens of meters per second to 1,000 meters per second and the pressure produced in hitting the target is about several dozen to several hundred kilobars. When a projectile velocity greater than 600 meters per second is desired, hydrogen or helium gas must be used. For even higher projectile velocity, a two-stage gun (Figure 4(b)) is required. In a two-stage gun the ignited explosive pushes the piston to compress the

high-pressure hydrogen or helium gas in the pump and the membrane ruptures only at a very high pressure. The maximum projectile velocity in a two-stage light gas gun is currently 8,000 m/s or so, producing about 7 Mbar of pressure in a high-density test piece. Compared to the chemical explosive driven flier, the flier velocity of a gas gun is continuously tunable, the reproducibility is good, and the flier remains flat.

A flier device that uses superheated, high-density metal vapor as the energy source is called an electric gun. In this device a bank of storage capacitors is quickly discharged through a metal film. Ohmic heating causes the metal film to make the solid-liquid-vapor transition over a very short time duration. Since the entire process takes place within 0.1-1 μs, the gaseous metal maintains its original density and is therefore a high-temperature, high-density metal vapor. This metal vapor drives the flier that was in contact with it. The size of the acceleration cavity is usually a few millimeters. The flier velocity from an electric gun varies between a few hundred meters per second to more than 10,000 meters per second. Recent data[6] show that the measured shock wave velocity for a tantalum flier velocity of 9.7 km/s and a tantalum test piece pressure of 7.8 Mbar agree with values obtained by other authors with other loading methods to within 2.7 percent (RMS deviation). The advantages of using the electric method are that the cost is low and the preparation time is short.

A rail gun[7] is a device that drives a flier electromagnetically. The principle is as follows: Consider a movable conductor (armature) and a projectile-flier assembly placed between two parallel rigid metal tracks. When a strong current is passed through the track-armature circuit, a strong magnetic field is produced between the tracks. The interaction of the field and the armature current produces a Lorentz force $F = \frac{1}{2} LI^2$. The velocity of the projectile-flier assembly is then

$$W = \frac{L}{2M} \int I^2 dt,$$

where I is the current, L is the induction per unit length of the track, M is the mass of the projectile-flier assembly and t is time. Therefore, for $I = 10^6$A, a current feeding time of 1 ms, L = 0.4 μH/m, and M = 5 g, the flier velocity is 40 km/s. Actually this high flier velocity has not been achieved because there are many energy loss mechanisms in the rail gun system and the flier tends to fragment at high Lorentz force. The newest data show that a flier velocity of 10 km/s has been published.

In 1981 C.E. Ragar[8] reported a flier system driven by the energy of a nuclear explosion. Using such a system he accelerated a 5 mm thick tantalum flier to 40 km/s. The acceleration cavity is 150 mm but the flier hits the target at a relatively large angle (~15°). If the performance can be improved, this technique will be the only contemporary technique for producing the highest shock pressure because a flier velocity of 40 km/s will produce about 100 Mbar of pressure in a test piece of average density.

III. Energy Deposition Method

When a target (test piece) is irradiated by a beam of high-energy particles (electrons, ions, or photons), part of the energy is reflected and part of the energy is deposited in a thin layer of the material. The thin layer of material is rapidly heated and becomes a hot layer. When the radiation power density is low (less than 10^9 W/cm^2), the hot layer can at most undergo the solid-liquid-vapor phase change and no ionization will take place. Through thermoelastic interaction, the hot layer expands against the adjacent cold target material and produces shock compression. For power densities greater than 10^9 W/cm^2, the mechanism for shock wave generation is different. In the case of a laser,[9] the irradiated target surface not only evaporizes but also becomes a layer of plasma. The plasma layer continues to absorb incoming laser energy and becomes a high temperature plasma. It then flies away into the vacuum space at a high speed. Due to momentum conservation, this flying-away plasma impacts an impulse and hence a shock wave on the "cold" target. In the meantime the escaping plasma decreases its density, which allows the laser to probe deeper into the target material, and produce new high temperature plasma. The newly formed high temperature plasma again escapes and sends a shock wave into the cold target. The process continues and maintains a steady shock in the target until the laser pulse ends. After the laser irradiation stops, the pressure on the surface abruptly drops to zero and a wave of rarefaction is sent into the target. At a certain depth the rarefaction wave will catch up with the wavefront of the shock wave and decreases the pressure. This process is depicted in Figure 5. The pressure-power density relationship in the laser generation of shock wave is given by

$$p = \alpha I_0^{\beta},$$

where I_o is the power density of the incident laser beam, and α and β are constants. For λ = 1.06 μm and I_o = (10^{12} - 5 x 10^{14}) W/cm^2, $\alpha \simeq 8$ and β = 0.6 - 0.8. For example, R.J. Trainor, et al., reported in 1981 that 3.5 Mbar was obtained in a gold target under the irradiation of I_o = 2.9 x 10^{15} W/cm^2.

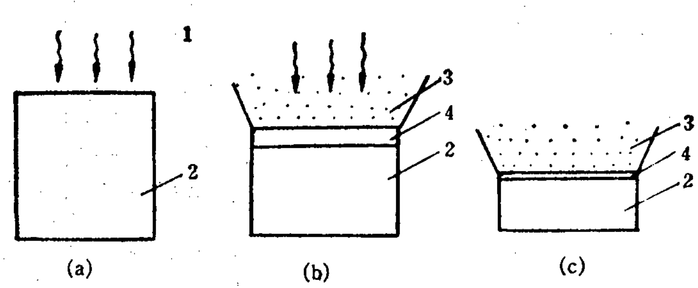

Figure 5. Laser Generation of Shock Waves

(a) Before laser irradiation; (b) During laser irradiation; (c) After laser irradiation
(1--Incident laser beam; 2--Target; 3--High-temperature plasma; 4--Layer of compressed target)

IV. Quasi-Isentropic Compression Technique

Isentropic compression occurs only when the material is undergoing adiabatic changes very slowly. Therefore, when the test piece is compressed by a gradual wavefront and not by a shock wave, the increase in entropy is small. We introduce two quasi-isentropic compression techniques in one dimension. One method uses a ramp generator and the other uses a buffer pad that has a variable shock impedance.

The ramp generator[10] is a device that changes a transient shock wave into a continuous loading wave. The principle is exactly the reverse process depicted in Figure 1. When a material has the property $\left(\frac{\partial^2 p}{\partial v^2}\right)_s < 0$ or $\left[\frac{\partial(u+c)}{\partial p}\right]_s < 0$, the wavefront of an isolated shock wave gradually spreads out as the propagation distance increases. When the wave emerges from the backside of the material, it becomes a pressure wave with a finite time duration. Materials with this property may be used in designing a ramp generator. Such materials include glass ceramics, fused quartz, and titanium silicate glass. However, the maximum amplitude of the continuous loading wave produced by a ramp generator can generally only reach 100-200 kbar because the condition $(\partial^2 p/\partial v^2)_s < 0$ breaks down at higher pressure.

To obtain a higher pressure amplitude, a buffer pad with a variable shock impedance[11] may be used. The principle and the construction are shown in Figure 6. The pad in front of the flier is made of a material with a gradually varying impedance. From wave analysis, a quasi-isentropic compression wave is produced in the target even though the pad material has the property $(\partial^2 p/\partial v^2)_s > 0$. Using this technique, 2 Mbar isentropic compression has been achieved.

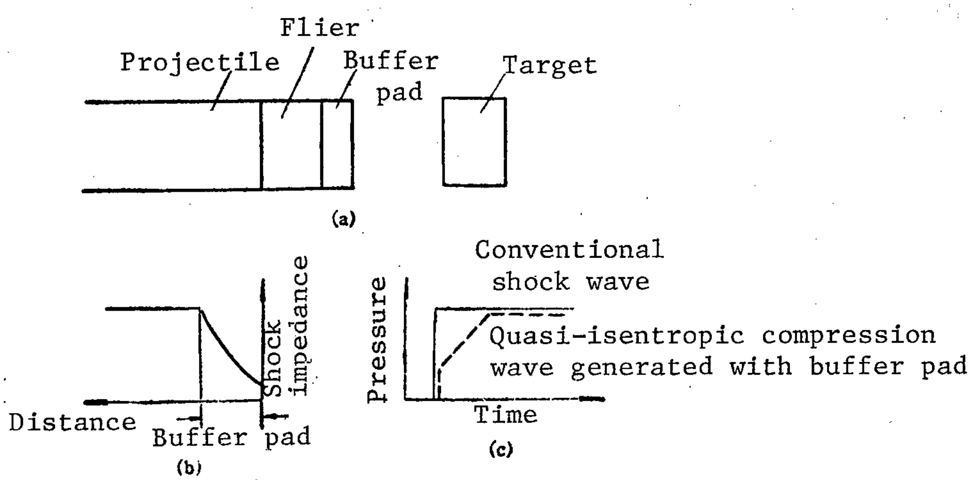

Figure 6. Generation of Quasi-Isentropic Compression With a Buffer Pad (a) Schematics of the device; (b) Shock impedance changes of the flier and buffer material; (c) Compression waveform at the interface

Figure 7 shows the obtainable pressure using the various dynamic high pressure techniques. If we take 10^7 bar as the dividing line between high pressure and ultrahigh pressure, then the mature technology for the high-pressure regime is the chemical explosive technique (content explosion and flier impact methods) and the high-pressure gas gun technique. Other viable techniques are the electric gun, the high energy particle beam energy deposition, and the isentropic compression method, but the measurement accuracy is still not very good. The only usable technique for the ultrahigh pressure regime is the nuclear explosion shock wave method. The laser method, the high energy electric gun, and the rail gun method are still under development and are not yet in the application stage.

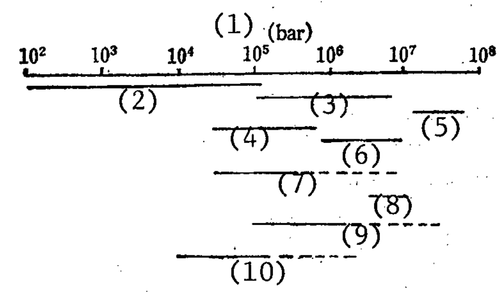

Figure 7. Achievable Pressures in Various Dynamic High-Pressure Techniques (Solid line--accurate pressure measurements available; dashed line--technology not yet mature)
1--Pressure; 2--Single-stage gas gun; 3--Two-stage gas gun; 4--Chemical explosion contact method; 5--Nuclear explosion method; 6--Chemical explosion flier impact; 7--Electric gun; 8--Rail gun; 9--Energy deposition (electron beam, laser); 10--Isentropic compression

In addition to the conventional p and v measurements, dynamic high-pressure techniques have also been used in recent years for temperature measurements to further our understanding of the high-pressure behavior of materials. In addition, good progresses have also been made in the direct measurement of high-pressure phase change (solid to solid and solid to liquid) and high-pressure physical properties such as electrical resistivity, index of refraction, and magnetism.

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LABORATORY OF INTERNAL FRICTION AND DEFECTS IN SOLIDS, HEFEI INSTITUTE OF SOLID STATE PHYSICS

Beijing WULI [PHYSICS] in Chinese Vol 15, No 5, May 86 pp 327, 294

[Article by Zhang Lide [1728 4539 1795] and Zhi Zhengang [2612 7201 0474]]

[Text] The Chinese Academy of Sciences has recently selected a number of research laboratories and institutes with high academic level and good facility for opening to domestic and foreign scientists. The Laboratory of Internal Friction and Defects in Solids of the Hefei Institute of Solid State Physics (ISSP), Chinese Academy of Sciences, is one of the laboratories chosen for opening. The academy has appointed Ge Tingsui [5514 1656 3606] as the director of the laboratory for a term of 3 years. Comrade Ge is a committee member of the mathematics and physics division of the academy, director of the ISSP, and a senior researcher.

The research direction of the laboratory is to investigate the solid vibration absorption spectrum, or the acoustic absorption spectrum, or the internal friction spectrum from extra low frequencies to ultrahigh frequencies. Through such studies, the relationship between the physical properties of the solid (especially the mechanical properties) and the structure, motion, and interaction of various defects in solids can be understood, and thereby provide theoretical and technological opportunities for the development of new solid state materials with specific mechanical properties.

In April 1985 the Chinese Academy of Sciences held an evaluation conference headed by Professor Feng Duan [7458 4551] and participated by 12 evaluators, including Professors Guan Weiyan [4619 1919 3508], Xu Zuyao [1776 4371 5069], Wang Yening [3769 2814 1380], and Li Wenbin [2621 2429 1755] and Associate Professors Wang Qimin [3769 0366 7036] and Zhang Jinxiu [1728 6651 0208], to evaluate the Laboratory of Internal Friction and Defects in Solids. The evaluation reports stated that, since the 1940's, the technique of internal friction has gradually developed into an important tool for studying the microstructures of solids. The internal friction method is sensitive and is well suited for the study of dynamic processes. It may obtain information that cannot be acquired by other methods. By combining internal friction with other experimental techniques, new grounds can be broken in the field of condensed matter physics. Comrade Ge has made unique contributions in the early studies on internal friction and is highly regarded on the

international academic scene. After the revolution he made considerable achievements in establishing an internal friction base in China and trained several generations of researchers. He is widely regarded as the leader in his field. Since the birth of the ISSP in 1982, Ge has led the institute in obtaining a number of research results on internal friction and publishing a series of high quality research papers in Chinese and foreign journals. The institute has particularly succeeded in the area of internal friction due to anomalous dislocations and interfaces. Work in these areas is unique and has attracted attention both here and abroad. The internal friction laboratory has made rapid progress, and, through independent development and imports, has established a complete series of internal friction setups to study the macroscopic and microscopic phenomena associated with creep, fatigue, phase change and hydrogenation over a frequency range of 10^{-5} to 10^{8} Hz and a temperature range of 80-1200 K. It has become a first rate internal friction laboratory in the world. The evaluation group therefore recommends an Open Laboratory of Internal Friction and Defects in Solids to Chinese and foreign scientists. This action should accelerate the pace in obtaining advanced research results and the training of a group of Chinese researchers.

Major research topics of the laboratory include:

I. Microscopic mechanism of the internal friction due to various defects and their interactions

1. Dislocation

2. Grain boundary (including substructure boundary and phase boundary)

3. Point defects (intrinsic and extrinsic)

4. Electronic defects

5. Phonons

6. Magnetic and electric domains

II. Microscopic mechanisms of internal friction in various solids

1. Metals and alloys

2. Amorphous materials (glass state)

3. Polymers and molecular crystals

4. Quantum solids (including semiconductors, ionic crystals and superconductors)

5. Liquid crystals

III. Applications of internal frictions to production related problems such as high temperature creep, intergranular segregation and fracture, super plasticity, plastic deformation, alloy hardening, surface hardening, fatigue brittlement, vibration absorption, high damping material, shape memory alloy, high elasticity material, hydrogen embrittlement and storage, phase change (including precipitation) and diffusion, restoration and recrystallization, radiation damage, ultrasonic (including surface wave) testing, acoustic emission and other materials related topics.

IV. Research and development of new internal friction techniques and apparatus.

V. Research and development of methods combining internal friction with microscopic defect observation and analysis, connecting macroscopic measurement and microscopic observation. Including:

1. TEM observation

2. SEM observation

3. Analysis of surface composition and structure

4. X-ray lineshape and diffraction analysis

5. Electrolyte relaxation and magnetic aftereffect analysis

Research projects that received priority support from the laboratory in recent years are:

1. Internal friction due to dislocation and point defect interaction

2. Interfacial internal friction

3. Internal friction in metallic glass

4. Internal friction and damping in solid polymers

5. Internal friction related to deformation

6. Internal friction related to phase change

7. Internal friction in quantum solids

8. Internal friction as applied to production related problems

9. Innovations in experimental technique apparatus

10. Defect observation and analysis combined with internal friction measurements.

Last year the laboratory held an expanded meeting of the academic committee and reviewed 11 research topics for the first stage (1 July 1985 to 30 June 1986). Four of the proposals were submitted by the Institute of Solid State Physics, five proposals were from other research units in China and two proposals were from abroad. Almost all the proposal research projects will be conducted jointly by two or more units.

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BUS ALLOCATION METHOD FOR DECENTRALIZED CONTROL DESCRIBED

Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese
Vol 15 No 7, 10 Jul 85 pp 4-6

[Article by Yan Zhixin [7051 1807 2946], Beijing Aviation Academy: "A Bus Allocation Method for Decentralized Control in a Distributed Computer Communications Architecture"]

[Text] The communication bus of a distributed computer system may have either centralized or decentralized control. Decentralized control generally results in better reliability of the communications architecture and allows simpler reconfiguration than centralized control. With decentralized control, in order to avoid conflicts between several bus controllers simultaneously trying to control the bus, two problems must be solved: establishing a control sequence for the bus control units, and using the control sequence, once established, for transfer of bus control from one control unit to another. For an application problem in a fixed cyclic environment, we propose below a bus allocation method which uses software to calculate the successor control unit in advance. Because the successor to the current control unit can be specified before there is a need to transfer bus control, the response time for transfer of control can be equivalent to that achieved in two typical hardware approaches, Ethernet and VDPA. In addition, because transfer of control uses a one-to-one command-to-response arrangement, reliability is guaranteed. This method requires no additional hardware and is easy to implement.

Features of the Bus Allocation Method

Fig. 1 is a block diagram of a sequential bus communications architecture. The devices connected to the bus may be processors, intelligent terminals or a mixture of intelligent and non-intelligent terminals. Only processors and intelligent terminals can function as bus control units.

An asynchronous allocation method is used. The bus is reallocated after the current control unit completes each transmission.

Algorithm entry is performed by the global entry method. Each control unit knows the predecessor and successor control signals.

A table-driven successor search algorithm is used. Using the successor pointer, the current control unit finds the number of the successor control unit for the current transmission in the current successor queue table (i.e. the already-existing successor table formed during the previous time segment) and sends a bus control transfer command to the successor control unit. Each control unit performs a calculation and search at the same time in the beginning of each computation segment and forms a queue of successor control unit numbers. Each transmission cycle is divided into several time segments.

Interlock synchronization is used. When the successor control unit receives the bus control transfer command it replies by emitting a response status word. When the current control unit receives the reply, the bus allocation process ends.

Response Time. The successor table is formed in advance; when the current control unit completes its communication, it can immediately find the number of the successor control unit in the queue and send out a bus control transfer command to it. The response time is equivalent to that achieved in the VDPA approach.

Reliability. Bus control transfer uses a one-to-one command-response scheme and the operation is asynchronously interlocked, resulting in high reliability.

Reconfiguration is simply performed. When the system monitor determines that some control unit has malfunctioned, it has only to amputate that unit and notify the other control units of its device number. Subsequently, when the other devices form successor queues, they will automatically eliminate the malfunctioning control unit.

Overhead. A certain amount of overhead is required for advance formation of the successor control unit number queue for each period. This overhead does not decrease the bandwidth of the bus: we need only estimate the size of the overhead for the various applications environments. In the electronic environment of a close air support (CAS) aircraft, if the greatest subfunction iteration rates are respectively 8, 16 and 32 per second, the overheads are respectively 1.67, 3.35 and 6.7 percent. While acceptable for many applications environments, these overheads are significant. For applications environments with more stringent requirements, the overhead requirements can be met by a suitable increase in system throughput.

Mathematical Model

We now establish a mathematical model based on Fig. 2. For convenience of treatment we assume that the system consists of three processors, one of which performs global control, while the other two are responsible for all

application tasks. The application tasks consist of four time-scheduled subfunctions whose cycle lengths form a series that increases by multiples of 2. The subfunction with the shortest cycle length is the first processor's subfunction No 0, which is designated ΔT_{10}, while the others are designated ΔT_{11}, ΔT_{20}, and ΔT_{21}, with $\Delta T_{20} = 2\Delta T_{10}$, $\Delta T_{21} = 4\Delta T_{10}$, $\Delta T_{11} = 8\Delta T_{10}$. Obviously, the transmission cycle length is $T = \Delta T_{ij\,max} = \Delta T_{11}$, and the entire transmission sequence is fixed within a cycle T. If the shortest subcycle length ΔT_{10} is taken as one computation cycle ΔT_c, then one transmission cycle T can be divided into 8 time segments. Although the time segments contain different transmissions and sequences, each segment has a fixed transmission and sequence. If we can find mathematical models for them, we can make the computation using T as the cycle length.

If the current transmission time is not the smallest transmission time in the present segment, then its predecessor transmission time is the largest of the set of all transmission times falling into the current time segment that are smaller than the current transmission time. If the current transmission time is the smallest transmission time of the current segment, then its predecessor transmission time is the greatest transmission time of the preceding segment. Thus

$$\left.\begin{array}{l} \text{If } t_{ijkc} \neq \{t \mid n_c \cdot \Delta T_c < t < (n_c+1)\Delta T_c\}_{min}, \\ \text{then } t_{ijkp} = \{\{t \mid n_c \cdot \Delta T_c < t < (n_c+1)\Delta T_c\} < t_{ijkc}\}_{max} \\ \text{if } t_{ijkc} = \{t \mid n_c \cdot \Delta T_c < t < (n_c+1)\Delta T_c\}_{min}, \\ \text{then } t_{ijkp} = \{t \mid (n_c - 1)\Delta T_c < t < n_c \Delta T_c\}_{max} \end{array}\right\} \quad (1)$$

If the current transmission time is not the largest transmission time of the current segment, then its successor transmission time is the largest element of the set of all transmission times that are larger than the current transmission time. If the current transmission time is the largest in the present segment, then its successor transmission time is the smallest in the following segment. Hence

$$\left.\begin{array}{l} \text{If } t_{ijkc} \neq \{t \mid n_c \cdot \Delta T_c < t < (n_c+1)\Delta T_c\}_{max}, \\ \text{then } t_{ijks} = \{\{t \mid n_c \cdot \Delta T_c < t < (n_c+1)\Delta T_c\} > t_{ijkc}\}_{min} \\ \text{if } t_{ijkc} = \{t \mid n_c \cdot \Delta T_c < t < (n_c+1)\Delta T_c\}_{max}, \\ \text{then } t_{ijks} = \{t \mid (n_c+1)\Delta T_c < t < (n_c+2)\Delta T_c\}_{min} \end{array}\right\} \quad (2)$$

In the above two sets of equations, T_{ijkc}, T_{ijkp} and T_{ijks} represent respectively the current transmission time of the k-th transmission of the j-th subfunction in the i-th processor, its predecessor transmission time and its successor transmission time; n_c is the segment number of the present time segment; ΔT_c is a time segment length equal to the shortest subfunction cycle length ; and t represents the transmission time and is an element of the set of transmission times.

We can use the above two sets of equations to find the predecessor and successor to the current transmission time; we then can correspondingly find the predecessor and successor control unit numbers for the current control unit.

The transmission time t for each segment can be found from equation (3) by successive summation with the segment number as variable and with the cycle lengths ΔT_{ij} for the various subfunctions as the varied parameter. The set of transmission times t falling into the present segment is a subset of the full set of transmission times obtained by substituting the present segment number into equation (3):

$$t_{ijk}(0) = t_{ijkF}$$

$$\left.\begin{array}{l} t_{ijk}(1) = \begin{cases} t_{ijk}(0) + \Delta T_{ij}, & \dfrac{\Delta T_c}{\Delta T_{ij}} = 1 \text{ and } t_{ijk}(0) < \Delta T_c \\ t_{ijk}(0), & \dfrac{\Delta T_c}{\Delta T_{ij}} \neq 1 \text{ or } t_{ijk}(0) \nless \Delta T_c \end{cases} \\ \\ t_{ijk}(n_c) = \begin{cases} t_{ijk}(n_c - 1) + \Delta T_{ij}, & \dfrac{n_c \Delta T_c}{\Delta T_{ij}} = \text{positive integer and } t_{ijk}(n_c - 1) < n_c \Delta T_c \\ t_{ijk}(n_c - 1), & \dfrac{n_c \Delta T_c}{\Delta T_{ij}} \neq \text{positive integer or } t_{ijk}(n_c - 1) \nless n_c \Delta T_c \end{cases} \end{array}\right\} \quad (3)$$

where t_{ijk}, n_c and Δt_c have the same meaning as in equations (1) and (2), ΔT_{ij} is the cycle length of the j-th subfunction of the i-th processor, and t_{ijkF} is the initial transmission time.

Bus Allocation Algorithm

The bus allocation process begins at the start of the computation segment. Each control unit has its own clock. The clock emits an interrupt during the each cycle ΔT_c of a segment, at which time the allocation process begins.

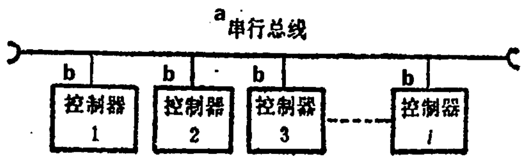

Fig. 1.

Key: a. Serial bus
b. Control unit

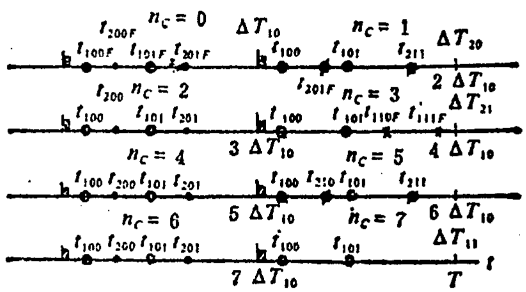

Fig. 2. Transmission-time sequence in a single cycle

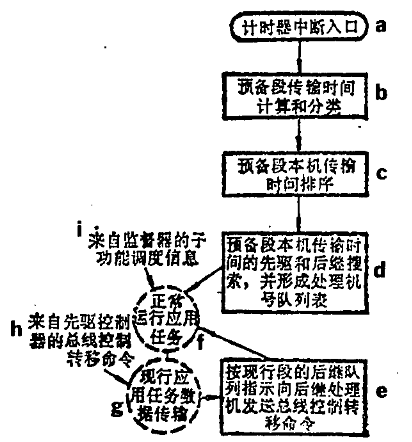

Fig. 3. Functional flowchart of bus allocation process

Key: a. Clock interrupt port
b. Preparatory-segment transmission time calculation and classification
c. Preparatory-segment sequencing of this processor's transmissions
d. Preparatory-segment search for predecessor and successor of this processor's transmission time, formation of processor number queue
e. Emission of bus control transfer command to successor processor indicated by current-stage successor processor queue
f. Application task under normal operation
g. Data transmission for current application task
h. Bus control transfer command from predecessor control unit
i. Subfunction scheduling information from supervisor

The clock of each control unit has global supervisor synchronization, and the synchronization cycle is equal to the cycle length of the subfunction with the shortest cycle length, i.e., one transmission cycle. The bus allocation process is shown in the flowchart of Fig. 3. The figure contains four modules, whose algorithms and programs will not be discussed here.

Response Time

If the bus control transfer program is written in the Z-8000 microprocessor assembly language, the transfer command is sent about 30-34 μs after calculation begins following completion of the current transmission. If the 1553B bus transmission protocol is used, about 20 μs is required for the successor processor to receive the transfer command after it is emitted.

Basic Protocols

The bus communication protocols are required to have a command-response type of bus control transfer function. This method is compatible with the MIL-STD-1553 protocol.

Experimental Verification

The mathematical model of the bus allocation method and algorithm described above were verified on a Felix C-256 computer. The test programs were written in the computer's assembly language and FORTRAN. The assembly language was used to implement the bus allocation algorithm itself, while FORTRAN was used only to control the experimental process in accordance with a predetermined plan, such as changing the time segment numbers, changing the local processor number (i.e. the processor number or current control unit number), specifying the number of a malfunctioning processor in reconfiguration experiments, and printing out the predecessor and successor control unit tables for all time segments both in normal system operation and in experiments simulating a malfunction of some processor.

The starting data used in the experiment were based on the peak task in close air support. They included a total of 17 subfunctions, allocated between processors 1, 2, 3, 4 and 5. Processor 0 was used as the system supervisor, performing global control and subfunction dispatching. During operation, the subfunctions generally required two bus transmissions: one, required by all sufunctions, in which the subfunction initiated command transmission and in which the system supervisor functioned as the bus control unit and sent the subfunction initiation command to the appropriate processor, and another in which, following completion of the subfunction, the processor in which it was performed acted as the bus control unit and supervisor of transmissions made by other processors and bus devices. The starting data were:

ΔT_{ij} (subfunction cycle length)

$\Delta T_{10} = 31.25\text{ms}$, $\Delta T_{11} = 31.25\text{ms}$,

$\Delta T_{12} = 31.25\text{ms}$, $\Delta T_{13} = 31.25\text{ms}$,

$\Delta T_{14} = 31.25\text{ms}$, $\Delta T_{20} = 62.5\text{ms}$,

$\Delta T_{21} = 31.25\text{ms}$, $\Delta T_{22} = 31.25\text{ms}$,

$\Delta T_{30} = 250\text{ms}$, $\Delta T_{31} = 62.5\text{ms}$,

$\Delta T_{32} = 125\text{ms}$, $\Delta T_{33} = 1000\text{ms}$,

$\Delta T_{34} = 8000\text{ms}$, $\Delta T_{40} = 62.5\text{ms}$,

$\Delta T_{41} = 31.25\text{ms}$, $\Delta T_{50} = 31.25\text{ms}$,

$\Delta T_{51} = 31.25\text{ms}$.

t_{ijkF} (initial transmission times):

$t_{100F} = 40\text{ms}$; $t_{101F} = 40.625\text{ms}$;

$t_{110F} = 3\text{ms}$; $t_{111F} = 9.875\text{ms}$;

$t_{120F} = 11\text{ms}$; $t_{121F} = 13.625\text{ms}$;

$t_{130F} = 14.125\text{ms}$; $t_{131F} = 16.625\text{ms}$;

$t_{140F} = 18\text{ms}$; $t_{141F} = 23\text{ms}$;

$t_{200F} = 3\text{ms}$; $t_{201F} = 11.125\text{ms}$;

$t_{210F} = 13\text{ms}$; $t_{211F} = 22.125\text{ms}$;

$t_{220F} = 22\text{ms}$; $t_{221F} = 29.375\text{ms}$;

$t_{300F} = 5\text{ms}$; $t_{301F} = 6.625\text{ms}$;

$t_{310F} = 6\text{ms}$; $t_{311F} = 10.375\text{ms}$;

$t_{320F} = 10\text{ms}$; $t_{321F} = 12.625\text{ms}$;

$t_{330F} = 12\text{ms}$; $t_{340F} = 142\text{ms}$;

$t_{341F} = 370.125\text{ms}$; $t_{400F} = 4\text{ms}$;

$t_{401F} = 15.25\text{ms}$; $t_{410F} = 46.625\text{ms}$;

$t_{411F} = 60.25\text{ms}$; $t_{500F} = 5.5\text{ms}$;

$t_{501F} = 10.75\text{ms}$; $t_{510F} = 14.5\text{ms}$;

$t_{511F} = 37.625\text{ms}$;

It is evident from the subfunction cycle lengths given above that the shortest subfunction cycle length is 31.25 ms and the longest is 8,000 ms. Thus a single system transmission cycle contains 256 segments.

The experimental results included: predecessor and successor control unit tables for every segment in the entire transmission cycle during normal system operation; and predecessor and successor control unit queue listings for each segment for each processor after a reconfiguration to deal with a malfunction of one of the processors (if the malfunctioning unit was, say, processor 1, then the effective processor word was 2). Because of space limitations, the experimental results are not reproduced here.

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USE OF SINGLE-BOARD COMPUTER TO EXTRACT WEAK SIGNAL FROM NOISE

Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese
Vol 15 No 7, 10 Jul 85 pp 7-8

[Article by Chen Yisheng [7115 1355 3932] and Le Jingjing [2867 0079 0079], Tianjin University: "Use of a Single-Board Computer to Extract a Weak Signal from Noise"]

[Text] We report the use of a TP801 single-board computer as a multipoint digital signal averaging device for synchronous accumulation of a repetitive signal in order to reconstruct clearly a weak signal so buried in noise as to be unrecognizable.

As shown in Fig. 1, the original signal that is to be detected is a mixture of a random noise voltage $V'_n(t)$ and an extremely weak useful signal voltage $V'_s(t)$. If this repetitive mixed signal is repeatedly fed to a synchronous adder, then the summing of the weak signal will be synchronous, so that the output useful signal voltage $V_s(t)$ will be directly proportional to the number of superpositions in the synchronous adder, while the phase and amplitude of the noise will be random and the output noise voltage $V_n(t)$ will therefore be proportional to the square root of the number of summations, $\sqrt{N}$. This is because if the superimposed signal is coherent, then amplitude superposition gives a resultant amplitude that is the vector sum of the component amplitudes: $\overline{V}_s(t) = \sum_{i=1}^{N} \overline{V}'_{si}(t)$. For the same phase and amplitude, we can use algebraic addition: $V_s(t) = NV'_s(t)$. For random noise, the intensities are superimposed and the composite intensity is $I_n = \sum_{i=1}^{N} I'_n i(t)$. If we assume as an approximation that all of the component intensities are equal, we obtain $I_n = NI'_n$. The intensity (or power) is proportional to the square of the noise voltage, i.e.

$$I_n = \frac{V_n^2(t)}{R_L}, \quad I'_n = \frac{V_n'^2(t)}{R_t},$$

or

$$\frac{V_n^2(t)}{R_L} = N \cdot \frac{V_n'^2(t)}{R_t},$$

$$V_n(t) = \sqrt{N} \cdot \sqrt{\frac{R_L}{R_t}} V'_n(t)。$$

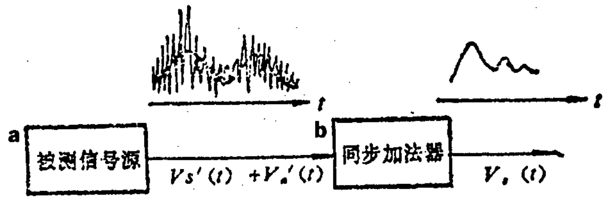

Fig. 1.

Key: a. Source of signal to be detected
b. Synchronous adder

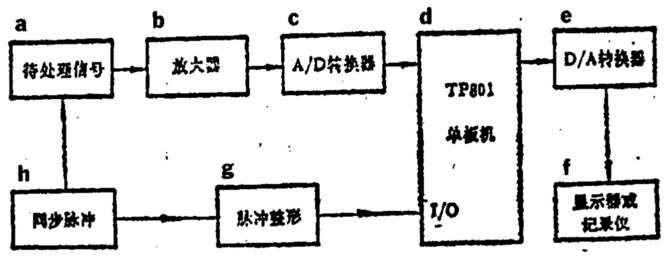

Fig. 2. Block diagram of implementation

Key: a. Signal to be processed
b. Amplifier
c. Analog-digital converter
d. TP801 single-board computer
e. Digital-analog converter
f. Display or recording device
g. Pulse shaper
h. Synchronization pulse

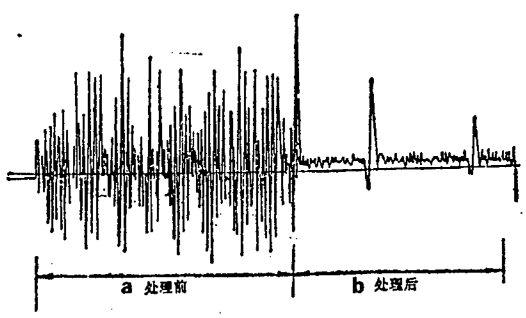

Fig. 3. NMR signal waveform before and after processing

Key: a. Before processing
b. After processing

Hence the signal-to-noise ratio at the synchronous adder output will be

$$\frac{V_s(t)}{V_n(t)} = \sqrt{N}\sqrt{\frac{R_I}{R_L}} \cdot \frac{V_s'(t)}{V_n'(t)},$$

where R_i and R_L represent the input resistance and output load of the adder. $V_s(t)/V'_n(t)$ is the signal-to-noise ratio of the signal fed to the adder. It is apparent that the synchronous adder increases the signal-to-noise ratio by a factor of $\sqrt{N}$.

If the signal-to-noise ratio at the input is $V'_s(t)/V'_n(t) = 10^{-2}$, then we can extract the useful signal from the noise by performing N = 10,000 iterations in the adder.

A single-board computer makes an excellent adder. But it can process only digital signals, so that before the continuous signal is input to the computer it must be sampled with an analog-digital converter (ADC). After the processing is completed, a digital-analog converter (DAC) must be used to convert it back to a continuous output signal. In order to synchronize the iterations, a precise synchronization signal must also be input.

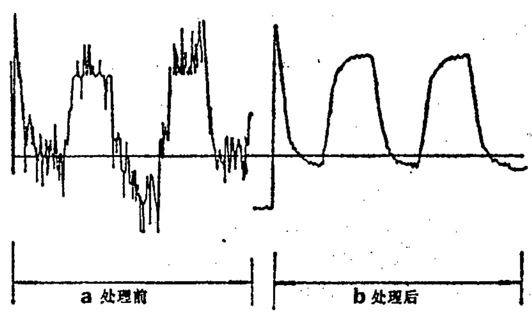

Fig. 4. Optoacoustic signal waveform 1 before and after processing

Key: a. Before processing
b. After processing

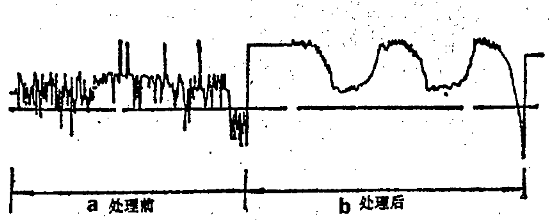

Fig. 5. Optoacoustic signal waveform 2 before and after processing

Key: a. Before processing
b. After processing

A block diagram of the implementation is shown in Fig. 2. First the voltage signal to be processed is amplified to a range of 0-10 V. It is then quantized in an ADC and entered into the single-board computer's memory. The memory is partitioned into numerous channels, each of which stores the voltage value corresponding to some level (or instant) of the repetitive signal. The synchronization pulse both triggers the repetitive signal and controls the channel switches on the single-board computer, causing accumulation to be performed after the repetitive signal is input into the appropriate memory channel. Following N iterations, the calculation results in each channel are directly proportional to the voltage representing the level of the repetitive signal. The computation results are sent via the single-board computer's DAC to a recording device or display so that the waveform of the useful signal can be determined.

Results

We now consider the processing of an NMR [nuclear magnetic resonance] signal buried in noise by means of the apparatus shown in Fig. 2.

The signal waveform before processing is shown on the left side of Fig. 3, and the waveform after processing is shown on the right side. The results of processing an optoacoustic signal are shown in Fig. 4. The left side of Fig. 4 shows a rather strong optoacoustic signal waveform with considerable noise, while the right side shows the waveform after processing. The noise was removed after only 256 iterations. An optoacoustic signal strongly obscured by noise is shown on the left side of Fig. 5, where no trace of the useful signal is visible. The right side shows the signal waveform satisfactorily restored by processing.

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LOW-TEMPERATURE, LARGE-AREA BLACKBODY RADIANT SOURCE WITH HEAT PIPE

Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese
Vol 5A, No 4, Aug 86 pp 299-304

[Article by Pang Shijie [7894 0013 2638] of Chinese Academy of Science Shanghai Institute of Technical Physics and Wen Yaopu [2429 5069 2528] of Institute of Spacecraft System Engineering; paper received 19 December 1985]

[Text] Abstract: This article reports on a large area blackbody radiant source successfully developed by use of principles of isothermal properties with an operating range of -50°C to +50°C. It includes a blackened honeycombed cavity array which produces a high emissivity (>0.995). Experimental results demonstrate that this blackbody radiation source possesses good isothermal behavior, changes temperature rapidly, has no noise, no vibration, and no contamination.

I. Introduction

In order to resolve the transition of spacecraft remote sensing instruments from qualitative images to the goal of qualitative information, the spacecraft remote sensing instruments undergo precise radiation calibration on the earth. For this purpose, beside needing a 80° to 100°K cold background vacuum chamber, a high emissivity standard blackbody radiation source is also required. We adopt the surface-source calibration method so we need a large area blackbody radiation source able to fill the aperture and viewing field of the remote sensing instrument.

A heat pipe acting as evaporation and condensation apparatus not only has good isothermal behavior but also has no vibration, no noise, does not contaminate the environment, and operates reliably while a honeycombed array can make a blackbody radiation source with higher effective emissivity. Consequently we combined the two to develop a heat pipe type large area low temperature blackbody radiation source.

II. Structure Design

1. Design of the Heat Pipe Structure

The basic structure of the heat pipe is seen in Figure 1 with an external view in Figure 2. In order to separate the operating surface from the

surroundings, to limit the radiation contribution coming from the surroundings, all around the blackbody source there must be a shielding device. Consequently the heat pipe design was made to have a cylindrical operating area. The cylinder walls then become a basically isothermal ideal shielding device from the operating surface.

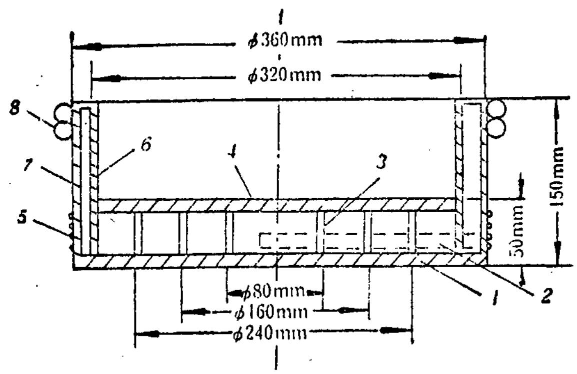

Figure 1. Configuration for the Pipe for the Area Radiant Source 1--Cylindrical plate; 2--Temperature sensor; 3--Support circle; 4--Operating plane circular plate; 5--Electric heater; 6--Inner cylinder; 7--Outer cylinder; 8--Temperature regulator

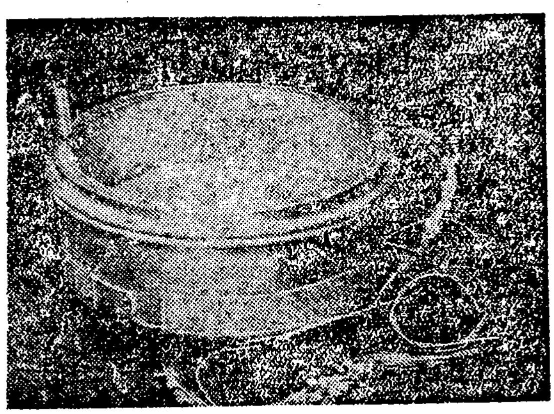

Figure 2. Photo of the Heat Pipe

In order to make the vapor which condenses on the upper surface of the cylinder form a uniformly thick liquid film, on this surface we lay two layers of No 250 stainless steel netting. On the walls of the inner and outer cylinder lamina and on the apron ring we also laid No 250 stainless steel to form a return flow channel for condensing fluid. The inner surface of the outer cylinder uses two layers of No 300 stainless steel to cover to make the heating zone network core able to be filled by the fluid working medium. The height increase of the working medium from the capillary action of the network core can be computed from the following formula:

$$\Delta h = \frac{4H}{D} \cos\theta; \qquad (1)$$

in which D is the effective capillary aperture of the metallic network, here taken as the length of a side of the opening, θ is the wetting angle of the working medium with respect to the stainless steel network, and H is the capillary rise height coefficient of the working medium whose value is

$$H=\frac{\sigma}{\rho_l g};\tag{2}$$

where σ is the surface tension of the working medium and ρ_t is the density of the fluid.

Here the capillary rise height takes one-third of the maximum value so

$$\Delta h=\frac{4H}{3D};\tag{3}$$

For a combination of ammonia and stainless steel, D = 0.05 mm and at 50°C, $H = 2.5 \times 10^{-6}\ m^2$ so we compute Δh = 66 mm, that is the heating zone height above the operating fluid surface should be less than 66 mm.

2. Analysis of Operating Plane Heating Behavior

The quantity of heat released by vapor condensation passes through the fluid film and is passed through the upper circular plate. Supposing the combined thickness of the fluid film and the metal network to be l_1, the combined coefficient of thermal conductivity to be K_1, the thickness of the stainless steel walls to be l_2, and its coefficient of thermal conductivity to be K_2 then the heat flow q which passes through a unit area is

$$q=\frac{T_v-T_2}{l_1/K_1+l_2/K_2};\tag{4}$$

which can be written as

$$T_v-T_2=(l_1/K_1+l_2/K_2)q;\tag{5}$$

in which T_v is the vapor saturation temperature and T_2 is the temperature of the upper circular plate outer surface (the operating plane).

Under conditions where the heat exchange between the operating plane and the outer surroundings does not change, that is q does not change, there is a relation between the value of T_v-T_2 and l_1, K_1, l_2, and K_2. Because l_1 and K_1 of each point on the upper plate are the same, T_v for each point is the same. Therefore if we want to keep T_2 for each point the same we must make l_2 be the same. Consequently homogeneously adhering the network core to the upper circle inner surface is important.

3. Honeycombed Array

Hexagonal, rectangular, and triangular small cavities all can be considered small blackbodies. An array composed from them is called a honeycomb array and can become a blackbody radiant source.

According to the proposal of A.R. Karoli and others[1], one can make trace-offs between the ratio of height to width of hollow cavities and the thickness of their walls to minimize the temperature gradient inside the hollow cavities. Considering questions of heat conductivity and bonding we used red copper honeycomb with each cell 3 mm wide, 25 mm high, and with walls 0.05 mm thick. The surface of the entire honeycomb was about 700 cm^2.

The honeycomb array is hard soldered onto a 5 mm thick red copper base plate and the entire base plate is in contact with heat pipe operating surface through heat conducting silicon grease. This maintains good heat contact and facilitates disassembly. On the back of the base plate there are channels for mounting thermocouples which are used to measure the low temperature of the base plate. The entire radiation source apparatus is shown in Figure 3.

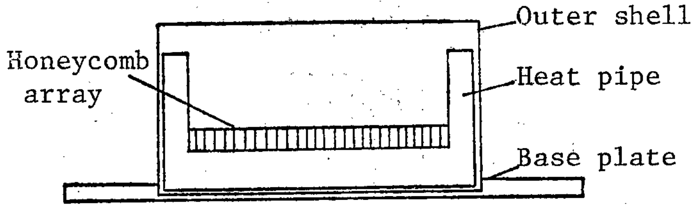

Figure 3. Schematic Diagram of the Radiant Source

III. Estimate of Emissivity

To date the effective emissivity of polygonal cells has been approximately calculated by use of appropriate right cylinders. The effective emissivity of a blackbody radiation source composed of a honeycomb array is the approximate average of the effective emissivity of the cells and the linking boundary emissivity. The honeycombs' height, H = 25 mm, length, L = 3 mm, and wall thickness, K = 0.05 mm. The blackbody cavity is coated with F_{26} black lacquer for which the hemispherically facing emissivity, E = 0.88.

Adopting the method of P. Campanaro and T. Ricolfi[2,3], we computed the source's effective normal emissivity, $E_N = 0.995$. According to reference [4] calculations the cell honeycomb effective low emissivity, $E_b = 0.998$ and considering the influence of the honeycomb wall thickness the total effective emissivity is about 0.995.

Because the honeycomb effective emissivity can only be estimated and there are many unreliable factors the precise value of the effective emissivity should be compared with standard black bodies but at present we do not provide this condition.

IV. Measured Tests and Results of Performance

1. Performance Tests Before Installation of the Heat Pipe System

(1) Tests under atmospheric conditions. On the operating surface and the cylinder walls there are separately spot welded 20 pairs and 10 pairs $\phi 0.2$

copper-constantan thermocouples all of whose temperature reference points are located in the temperature sensor (see Figure 4).

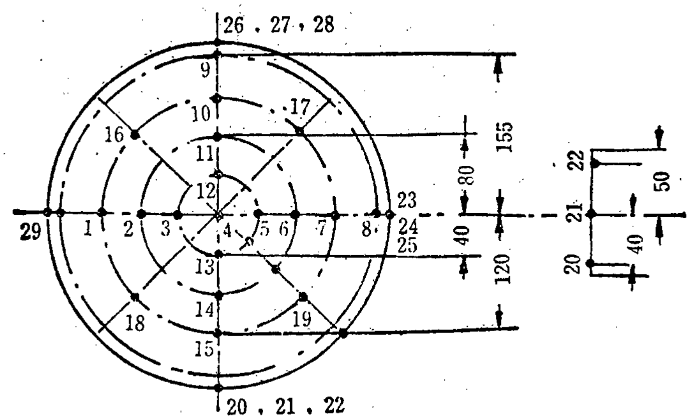

Figure 4. Schematic Diagram of the Distribution of Thermocouples (measurements in mm)

We use 0-8# thermocouples to measure the operating surface radial temperature distribution and thermocouples 1#, 7#, 10#, 15-19# to measure the annular temperature distribution while the other points are reference test points.

The temperature control instrument uses a DWT thermostat and the temperature measuring instrument uses a PZ-12 digital voltmeter with a resolution ratio of 0.1 μV. Since these were tests under atmospheric conditions the operating temperature was between 0 and 50°C and we could only measure temperature zones above 0°C, dividing at each 10°C in an operating mode getting measurements for the six operating modes of 0, 10,...,50. The standard deviation of their non-uniformity σ_{n-1} were respectively 0.01, 0.008, 0.009, 0.019, 0.030, and 0.050.

(2) Tests under vacuum conditions. Placing the heat pipe in a Km-1A ultra-high vacuum chamber we wrapped the sides in 20 layers of dacron film and nylon fabric and put organic glass under the base of the heat tube all to serve as heat insulation. The distribution of thermocouples is shown in Figure 5.

The thermoelectric potential of the thermocouples was measured by using a PF15 multicircuit digital voltmeter with resolution ratio of 1 μV which printed output after each measurement. Direct current was used to apply heat to raise the temperature of the heat pipe and to lower it we used the temperature regulator to pass liquid nitrogen to speed cooling. A DWT-702 precision thermostat was used for temperature control.

With conditions of high vacuum normal background and cold background separately we tested the isothermal properties of the heat pipe operating surface whose σ_{n-1} were correspondingly 0.013-0.09°C and 0.10-0.14°C.

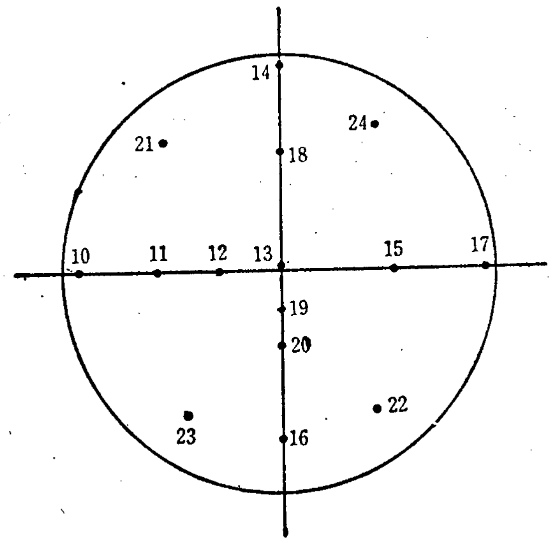

Figure 5. Schematic Diagram of the Distribution of Thermocouples

2. Performance Tests After the Heat Pipe System Is Installed To Form a Blackbody

At different positions of the honeycomb base plate are installed several copper-constantan thermocouples used to measure the absolute temperature. All the thermocouples used are corrected in a ZDW-100 model precision constant temperature oven. The distribution of the thermocouples is as shown in Figure 6. Of these thermocouples (ϕ0.2) 4-8# are to measure the low temperature at the honeycomb base plate and thermocouples (ϕ0.2) 9-17# are to measure low temperature at the honeycomb.

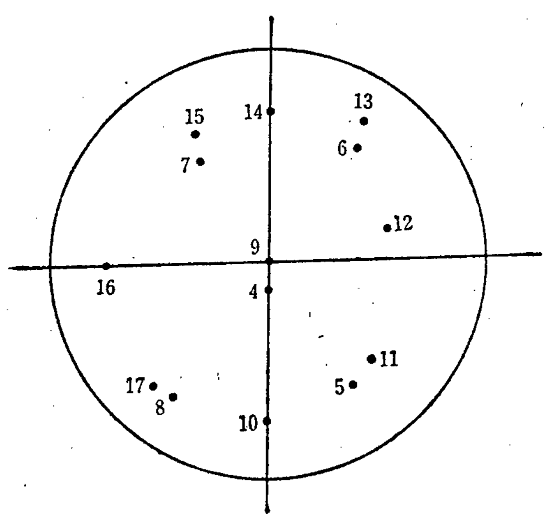

Figure 6. Schematic Diagram of the Distribution of Thermocouples

The test results are as follows:

The blackbody source operating temperature range could reach -65°C to +50°C. The temperature control stability attained 0.05°C/20 min. Under atmospheric conditions when the surface source temperature was 35-50°C its σ_{n-1} = 0.016-0.037°C. In high vacuum with conditions of normal temperature background and cold background when the surface source temperature was -60 - +50°C its σ_{n-1} was respectively 0.012-0.050°C and 0.16-0.20°C. The σ_{n-1} vs T curve is shown in Figure 7.

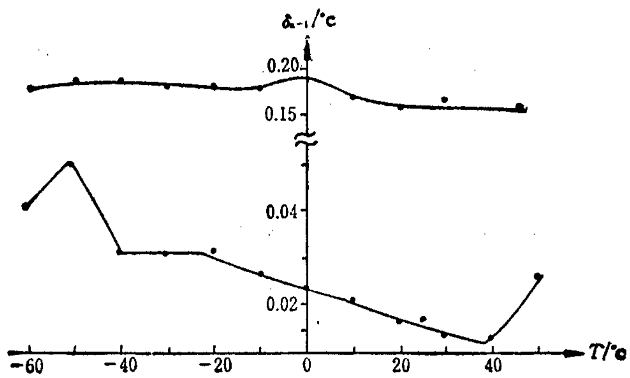

Figure 7. The σ_{n-1} vs T Curve

V. Uncertainty and Analysis of the Temperature Measurement

Source surface measurements used a copper-constantan thermocouple standardized by the Shanghai Measurement Bureau with a precision of ±0.2°C.

1. Analysis of Surface Uniformity Uncertainty

(1) The smallest step value of the PF15 digital voltmeter serving as measuring instrument is 1 μV (equivalent to a difference of 0.025°C) so the uncertainty introduced by this error is σ_{PF15} = ±0.025°C.

(2) Temperature control stability is 0.05°C/20 min. However, in the less than 1 minute needed to measure the surface temperature difference it only allows the PF15 to have a jump of 1 μV so the uncertainty introduced by the temperature control precision is $\sigma_{\text{temperature control}}$ = ±0.025°C.

(3) The ϕ0.2 constantan wire used was locally refrigerated using liquid nitrogen and its temperature difference potentials are all less than ±3 μV (equivalent to ±0.08°C) so $\sigma_{\text{material uniformity}}$ = ±0.08°C.

(4) From the point of view of measured test data, the nonuniformity caused by thermocouple welds could not be more than ±0.05°C. The article takes σ_{welds} = ±0.05°C.

Based on the above analysis we can get that the total uncertainty of heat pipe type surface source uniform temperature measured data $\overline{\sigma}_{\text{total}}$ = ±0.1°C.

2. Analysis of the Uncertainty of Blackbody Temperature Measurement

(1) The thermocouple standardization error $\sigma_{standardization} = \pm 0.2°C$;

(2) Source surface temperature nonuniformity $\sigma_{n-1} = \pm 0.2°C$;

(3) PF15 digital voltmeter measuring error $\sigma_{PF15} = \pm 0.025°C$;

(4) Error introduced by the temperature measuring reference point (freezing point) $\sigma_{reference} = \pm 0.1°C$;

(5) Error introduced by the thermocouple welds $\sigma_{welds} = \pm 0.05°C$;

(6) Error introduced by the thermocouple connectors $\sigma_{connector} = \pm 0.1°C$;

(7) Error introduced by nonuniformity of the thermocouple material $\sigma_{material\ uniformity} = \pm 0.08°C$;

Total error in measuring temperature $\sigma_{total} = \pm 0.33°C$.

VI. Discussion

1. From experimental results we see that the σ_{n-1} under conditions of vacuum and cold background is larger than the σ_{n-1} for conditions of vacuum and normal temperature background. It can be seen that this determinant creates the radiation differential of the computed heat sink (producing the cold background) with respect to different positions on the blackbody radiant surface. Computational results demonstrate that for radiation surface temperatures in the range -50°C to +50°C the temperature difference between the center of the blackbody radiant source and edge positions was only 0.01 to 0.03°C. From this we believe that σ_{n-1} is larger for vacuum cold background not due to a cold background created by heat sinking but rather is caused by larger errors in measuring temperature.

2. Thermocouples were installed in the honeycomb walls to measure the temperature gradient of the honeycomb walls. Because the thermocouple wires were thin (ϕ0.1) they break very easily and in the experiment some were already broken so the test results were not perfect. The estimated maximum temperature difference of the honeycomb base and the honeycomb top was about 3°C so a change of normal emissivity of a non-equivalent temperature cavity with a temperature difference of 3°C and an equivalent temperature cavity could be ignored. Therefore we did not again do non-equivalent normal emissivity computations.

Acknowledgments--Participating in this work were our colleagues Wang Zhengguan [3769 2973 1351], Bao Genlin [7559 2704 2651], Fu Kejian [0265 0344 0313], and Pan Jieyi [3382 0094 0308]. Jiang Huixin, Chin Gendi, Zheng Xiulan, and Sun Shuying took part in experiment preparations and a portion of the experimental work. The two master workers Chu Zhaoshan and Wang Qian gave energetic assistance in metal working and we discussed this work with Professor Kuang Dingbo and Pang Huixing with great benefit. To all of these individuals we express our gratitude.

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HEAT UTILIZATION OF BUTANOL VAPOR

Shanghai HUAXUE SHIJIE [CHEMICAL WORLD] in Chinese Vol 27, No 9, Sep 86 pp 412-414

[Article by Bo Xinqiang [2672 2450 1730] of the Shanghai Solvent Factory]

[Text] The distillation process widely used in chemical industry production is a technical process with very high consumed energy. In the production of acetone butanol by fermentation method, nearly two-thirds of the total energy consumed by the products is used in the distillation process of dissociation and purification. China has over 20 factories using the fermentation method to produce acetone butanol with total production reaching 80,000 tons/year and expended fuel equivalent to over 200,000 tons of coal each year.

Consequently working out how to save energy has very major significance in this industry.

There are many ways to conserve energy in distillation. One can raise the distillation efficiency lowering the backflow ratio, use high heat transfer efficiency heat exchange equipment to recover heat, or use heat pump technology to reach the goal of lowered energy consumption. Of these, application of heat pumps to save energy in distillation processes, whether the compressor type or the absorption type heat pump, although an obviously energy efficient technology, has very seldom been applied domestically to industrial factories. This is due to technical and economic factors as well as the short supply of electricity in China. Therefore we addressed ourselves to special features of various distillation processes and on the basis of energy consumption analyses done on the distillation process were indeed able with success to select some effective energy saving measures. For example, leading the butanol vapor of the top portion of the No 1 butanol tower directly to the bottom part of the ethylene-propylene tower, gaining objective energy saving results is an example of success [1].

In September of 1984 we looked at the characteristics of the fermentation method acetone butanol distillation process. Again we carried out the energy saving measure of taking the top part vapor of the No 2 butanol tower to provide heating for the acetone tower. Through the last two years of actual use the technique has been reliable, the product quality has matched the national first grade standard, and each hour 1.5 tons of acetone tower heating vapor can be saved.

I. The Technical Process before the Reforms

The butanol taken from the No 1 butanol tower entered into the lower part of the butanol purification tower (i.e. the No 2 butanol tower) and there was an evaporator at the bottom of the butanol purification tower. The butanol vapor evaporated from the butanol purification tower top is led into the condenser. The condensed liquid mostly backflows, a small part low boiling point material goes into the ethylene-propylene tower to remove low boiling point impurities. A side line of the middle part on the butanol purification tower collects the butanol finished product. The backflow ratio of this tower is 2.2. The tower top is at standard pressure, its temperature is controlled at 115 C to 120 C while the pressure at the tower bottom is 21.6 kbar and the temperature there is 125 C. The tower base drains butanol rich in high boiling point impurities into the No 1 butanol tower to recover the butanol (see Fig. 1).

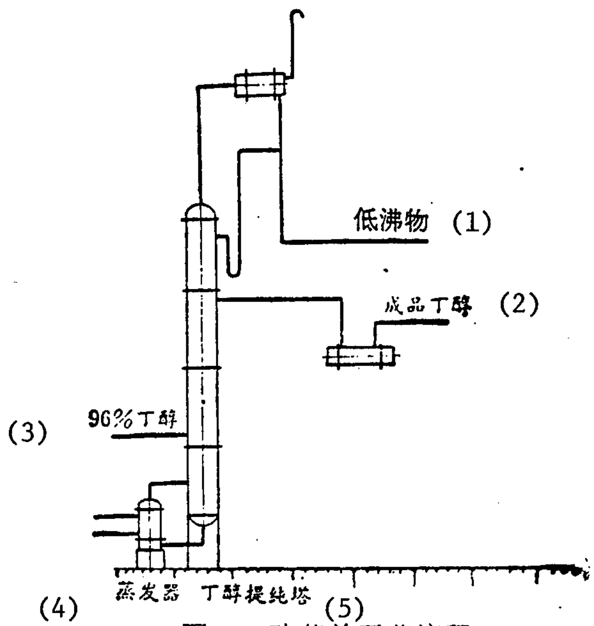

图 1 改革前工艺流程

Fig. 1. Technical Flow Process before the Reform

Key:
- (1) Low boiling point material
- (2) finishec butanol
- (3) 96% butanol
- (4) Evaporator
- (5) Purification tower

II. Technical Process after the reform

Through energy consumption analysis, we know that each hour the acetone tower quantity of heating vapor used is 3.2 tons and the tower base temperature is 100°C. The quantity of heat carried in the vapor at the top of the butanol purification tower converted to water vapor mass is 1.8 tons with a temperature of 115 to 120°C. This can be used to act as a heat source for heating the acetone tower, replacing a portion of the water vapor. The concrete means for doing this is take the butanol vapor originally led into the condenser and change it to led into a newly added evaporator for the acetone tower. The butanol vapor in this evaporator carries on heat exchange with the fluid in the bottom part of the butanol tower then the butanol vapor is condensed to liquid and runs into the cooler. Passing through cooling it again enters the central channel and the pump again sends it to the top of the purification tower using the original regulator valve to regulate backflow or low boiling point material. The acetone tower's original evaporator is still used as before to supplement the portion of the heat not made up by the butanol heated acetone. The amount of water vapor heat supplemented is influenced by the magnitude of the vapor from the top of the butanol purification tower. When this quantity of butanol vapor is large the supplemental heating water vapor is automatically reduced and vice versa. The important parameter for doing automatic regulation is the pressure in the bottom part of the acetone tower which we generally controlled to around 39.2mbar. Furthermore the fluid level in the central channel should be maintained at a stable level. Automatic regulation is achieved through the size of the open and closed pump output automatic regulating valve. The technical flow process after this reform is seen in Fig. 2.

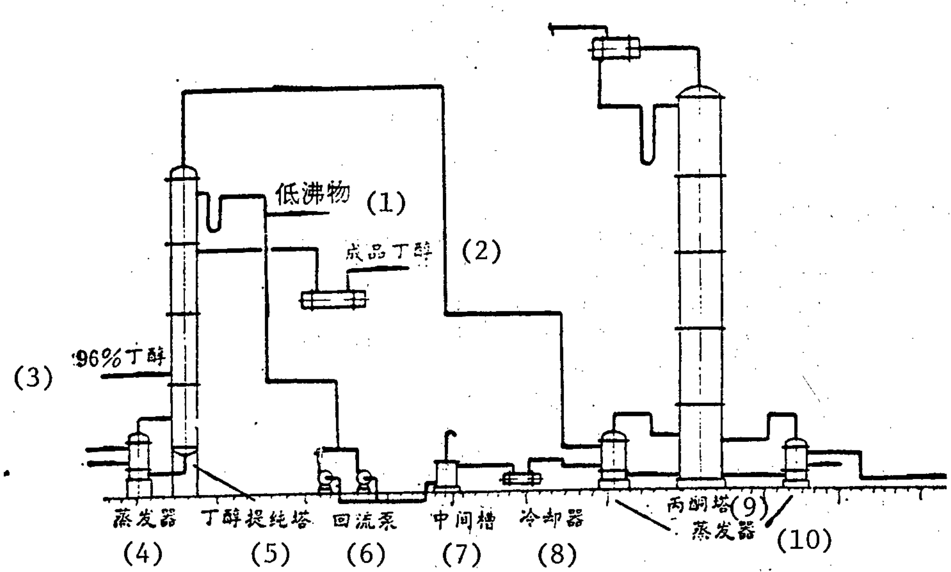

Fig. 2. Technical Flow Process after Reform

[key on following page]

Key:

(1) Low boiling point material
(2) Finished butanol
(3) 96% butanol
(4) Evaporator
(5) Butanol purification tower
(6) Backflow pump
(7) Central channel
(8) Cooler
(9) Acetone tower
(10) Evaporators

III. Operation Control

After the butanol purification tower top vapor thermal energy was utilized, it increased the resistance of the tower itself, caused the tower pressure to increase, made the operating temperature rise and other changed conditions as in the table below.

Table of Siutation with Operating Conditions

	(1) 顶压 (千帕)	(2) 底压 (千帕)	(3) 顶温 (°C)	(4) 底温 (°C)	(5) 出料温度 (°C)	(6) 加热蒸汽压力 (千帕)
(7) 塔顶热量回收前	0	19.6	116	125	118	314~353
(8) 塔顶热量回收后	9.8	29.4	121	129	122	314~353

Key:

(1) Top pressure (kbar)
(2) Bottom pressure (kbar)
(3) Top Temperature
(4) Bottom Temperature
(5) Output Material Temperature
(6) Heating Vapor Pressure (kbar)
(7) Before: Tower top thermal backflow
(8) After: Tower top thermal backflow

At the beginning because we were not accustomed to conditions of increased pressure and temperature we adopted the method of lowering the butanol purification tower heating vapor pressure. Then although the tower's pressure and temperature approached the situation before the change, it had an effect on the quality of the butanol product. This was because reducing the heating vapor lowered the backflow ratio of this tower and decreased the dissociation efficiency. After we adopted the method of lowering the butanol vapor condensing system resistance which made it so that under conditions of maintaining unchanged the heating butanol vapor the top pressure rose only to 9.8kbar and insured that the product quality was not affected.

IV. Economic Benefits

After realization of this energy saving reform, there was eliminated a $100m^2$ stainless steel helix plate vapor-liquid condenser, valued at 80,000 yuan and the cooling water used by the condenser was reduced by $25m^3$ per hour. The cooling water converts to 5 kwh of electricity each hour. The quantity of heat of the butanol vapor actually replaces 1.5 tons of acetone tower heating water

vapor each hour. This converts to an annual saving of 800 tons of fuel oil. The newly added equipment consists of one carbon steel $100m^2$ evaporator, one $12m^2$ plate cooler and one $1.5m^3$ central channel, and two central pumps (one spare). The central pump uses 2 kwh electricity each hour and the cooling uses $10m^3$ water or 2 kwh electricity. This way there is savings on the use of electricity compared to before adoption of the energy saving program and the capital and depreciation for additional equipment is about the same as before the implementation. Consequently, each year the 800 tons of fuel oil saved is purely economic benefit with a value of 200,000 yuan, so the capital for the reform can be completely recovered in less than half a year.

The results of this reform passed appraisal in April 1985 and have reached to the advanced level of domestic industries.

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NICKEL SERIES ELECTROPLATING SOLUTIONS

Shanghai HUAXUE SHIJIE [CHEMICAL WORLD] in Chinese Vol 27, No 9, Sep 86 pp 387-389

[Article by Li Jisen [2621 1015 2773], Bong Xiuying [7895 4423 5391], He Zijian [0149 1311 7003], Hu Guangming [5170 0342 2494], and Huang Yaozeng [7806 5069 2582] of the Chinese Academy of Sciences Organic Chemistry Research Institute]

[Excerpts] Introduction

Since we completed development of 22 kinds of commonly used electroplating solutions in 1982, electroplating technology in China has advanced to a stage of widely spreading applications. Through national combined efforts electroplating technology has made very great contributions for national economic construction. In recent years the Buangzhou Trade Show has also opened exports and electroplating technology and products have been exported to southeast Asian countries. Under these conditions there is a pressing need to perfect electroplating technology such as power sources and seriation of electroplating solution varieties, modularization of electroplating techniques, etc. Among these the seriation of electroplating solutions varieties is the most pressing and most important at present. Since only after electroplating solution varieties have been seriated can coating types be complete and there will be the possibility of further expanding the range of application of this technology and entirely exploiting its advantages. Consequently, beginning in 1983 we have continually developed over 60 new variety directions for electroplating solutions and, apart from nobel metal plating solutions, basically realized seriation of electroplating solutions. The China People's Liberation Army armored forces Technical Academy did theoretical capability and technical capability test and selection of technical parameters for the electroplating solutions mentioned above as well as technical comparisons with corresponding foreign electroplating solutions. The results demonstrate that the capability of these electroplating solutions approach or reach the levels of similar foreign products. We will continue to publish the performance and range of application of these electroplating solutions. This article only introduces the capability and application range of the nickel series electroplating solutions.

There are many varieties of nickel series electroplating solutions. At present we have identified sixteen: special nickel, acidic nickel, high accumulation

nickel I, high accumulation nickel II, half luster nickel, high accumulation half luster nickel, low stress nickel, rapid nickel, alkaline nickel, special rapid nickel, axial nickel, high temperature nickel, nickel "M" I, nickel "M" II, and nickel "M" III. In addition black nickel* is still in development. These different nickel solutions possess individual capabilities and applications. Below we separately recount their major capabilities and range of application (see the following table).

Metallic Ion Content and Major Technical Conditions of Nickel Series Electroplating Solutions*

(1)	(2)	(3)	(4)	(5)
镀液名称	金属离子含量(克/升)	工作电压(伏)	相对运动速度(米/分)	耗电系数
(6) 特殊镍	85	10～18	5～10	0.744
(7) 酸性镍	105	8～14	6～12	0.232
(8) 高堆积酸性镍-I、II	52	6～14	6～10	0.275
(9) 半光亮镍	62	4～10	10～14	0.122
(10) 高平整半光亮镍	73	6～10	6～15	0.410
(11) 低应力镍	75	10～25	6～15	0.214
(12) 快速镍	52	8～14	6～12	0.104
(13) 碱性镍	54.4	8～12	6～12	0.119
(14) 特种快速镍	54.4	10～14	6～12	—
(15) 轴镍	50	6～12	6～10	0.15
(16) 中性镍	28	10～14	6～10	0.119
(17) 高温镍	103	6～14	6～10	0.552
(18) 镍"M"-I	16.4	6～14	4～6	0.348
(19) 镍"M"-II	16.4	6～14	4～6	0.60
(20) 镍"M"-III	16.4	6～14	4～6	0.348

Key:
(1) Solution Name
(2) Metal Ion Content (gram/liter)
(3) Operating Voltage (volts)
(4) Relative Transfer Speed (meters/min)
(5) Electricity Consumption Coefficient
(6) Special Nickel
(7) Acidic Nickel
(8) High Accumulation Nickel
(9) Half-luster Nickel
(10) High Smoothness Half-luster
(11) Low Stress Nickel
(12) Rapid Nickel
(13) Alkaline Nickel
(14) Special Rapid Nickel
(15) Axial Nickel
(16) Neutral Nickel
(17) High Temperature Nickel
(18) "M" - I
(19) "M" - II
(20) "M" - III

* The technical data in the table was provided by the Chinese People's Liberation Army armored force Technical Academy.

1. Special Nickel

Special nickel plating solution is a dark green translucent aqueous solution, acidic, pH $<$ 2, and specific gravity 1.23.

This solution is stable; the nickel layer and the base metal have extremely good binding strength; it can be broadly used for doing nickel plating; is also commonly called a foundation layer; and its thickness is generally between 0.01 and 0.03mm. It can be applied to alloy steel, chromium, nickel, and other high melting point, difficult to plate metals.

2. Neutral Nickel

Neutral nickel solution is a dark green, translucent, aqueous solution, nearly neutral, pH$\sim$7.7, specific gravity 1.22.

This solution is rather stable; gives plating coats that are very dense; and corrosion resistant. Primarily it is used to make a foundation coat for difficult to plate matrix metals or those loose structured matrix metals like cast iron, cast steel, nodular cast iron or forge polished aluminum. It can also act as accumulative material and must be alternately deposited with acidic cadmium or copper to form a thick plating layer and can be used on tin or zinc and other matrix metals or plating layers which are easily eroded by acid solutions. Because the deep plating properties of neutral nickel are good some times it can also be used on parts with sharp internal angles or blind cavities, for aluminum parts one can substitute acidic nickel to make a deposit layer, and for hard soldering properties is especially useful. Separately it can serve as a foundation plating layer for *plated black nickel or back nickel*, when desiring other electroplating with no luster and luster diffusion.

3. Acidic nickel

Acidic nickel solution is a green, translucent, aqueous solution, acidic, pH$\sim$2.3, specific gravity 1.29.

This solution deposits quickly; the Brinell hardness of the plating layer is between 450 and 500; it can be used for most situations of nickel plating; the plating coat is thin and when the thickness exceeds 0.20mm stress fractures can appear. This solution is used to do a foundation layer then replaced by special nickel.

4. High accumultion acidic nickel - I

High accumulation acidic nickel - I solution is a green, translucent, aqueous solution, acidic, pH$\sim$2.8, specific gravity 1.18.

This solution deposits quickly; gives thick layers; the plated layer stress is low; moreover it possesses hardness and higher abrasion resistance as well as corrosion resistance. Used with aluminum, chromium alloys, molybdenum, titanium and other difficult to plate metal surfaces it has good binding strength.

Because the plating coating still possesses low hydrogen embrittlement, it can be used directly on ultra high strength steel and baking treatment to remove hydrogem is not necessary after plating.

5. High accumulation acidic nickel - II

High accumulation acidic nickel - II solution is a green, translucent, aqueous solution, acidic, pH$\sim$2.9, specific gravity 1.17.

The characteristics and applications of this solution are the same as for high accumulation acidic nickel - I, except that the color of the plating coat is more white.

6. Half luster nickel

Half luster nickel solution is a green, translucent, aqueous solution, acidic, pH$\sim$2, specific gravity 1.20.

This solution deposits quickly; the structure of the plating coat is dense; it is resistant to abrasion and corrosion; and the degree of surface finish is good. It is often used for surface plating layers. Sometimes after high speed plating nickel, high accumulation acidic nickel, or alkaline nickel a layer of half luster nickel is plated on top to improve the apparent capabilities of the plating layer.

7. High smoothness half luster nickel

High smoothness half luster nickel solution is a green, translucent, aqueous solution, acidic, pH$\sim$1.9, specific gravity 1.21.

The technical properties of this solution are stable; it deposits quickly; the plating layer obtained is smooth and lustrous; it has a high degree of hardness and resists abrasion well; and with extremely good resistance to wear performance is a most broadly applied plating. Primarily used in plating protective layers and ornamental plating it can also be used for plating of lead and inert metals.

8. Low stress nickel

Low stress nickel solution is a green, translucent, aqueous solution, acidic, pH$\sim$3, specific gravity 1.20.

The technical properties of this solution are stable; the plating structure is dense; and it has a higher compressive stress. However, the application temperature of the plating solution and the stress of the plating layer are closely related. Under normal temperatures the plating coat obtained is a tensile stressed plating, that is the stress value is positive. When the plating solution is heated to 50°C the plating coat is a low stress plating, that is the stress value is negative and as its thickness is increased the stress value is reduced. When a thickly deposited plating is desired it can be used for a protective plating. It is also used for alternate layers in laminated plating.

9. Rapid nickel

Rapid nickel solution is a blue green, translucent, aqueous solution, alkaline, pH$\sim$7.5, specific gravity 1.15.

This solution is relatively stable within a fixed pH range; deposits rapidly reaching 12.7 microns; plating layers have rather good resistance to abrasion and a fixed hardness; generally the plating layer hardness HRC is above 50. It is mostly used for restoring measures and making working plating layers. If even better abrasion resistance is desired one can cover it with a layer of nickel-tungsten alloy or half luster nickel, or high smoothness half luster nickel. It is suited for use on all matrix metals. The failing of rapid nickel is when the plating is thick it crystallizes and easily becomes rough.

10. Alkaline nickel

Alkaline nickel solution is a blue green, translucent, aqueous solution, alkaline, pH$\sim$8, specific gravity 1.20.

This solution was developed from an improved rapid nickel solution. The plating solution is stable; technical performance is very good; and is noncorrosive for matrices. Plating layers obtained are dense; the stress is low; thick plating can be achieved; moreover thick plating does not easily create roughness. Primarily it is used for plating measures or working plating and can be used to replace neutral nickel.

11. Special rapid nickel

Special rapid nickel solution is a blue green, translucent, aqueous solution, alkaline, pH$\sim$7.8, specific gravity 1.19.

This solution was developed specially to increase further rapid nickel. The plating solution is stable; it deposits quickly; is noncorrosive to matrices; is appropriate for use on all matrix materials; possesses fine binding strength; the platings obtained are dense; and the color and lustre is whiter and brighter than rapid nickel. Mostly it is used on restored workpiece measures and difficult to plate matrix metals and does not produce roughness in thick coats.

12. Axial nickel

Axial nickel also called XHB nickel solution, is a dark green, translucent, aqueous solution, alkaline, pH$\sim$7.8, specific gravity 1.18.

The solution is stable; the plating layers are lustrous; and has resistance to corrosion. Technical performance is good; plating structure is dense; and resists loss of fatigue strength well. It is exclusively used in plating of axle shaft type parts.

13. High temperature nickel

High temperature nickel solution, is a green, translucent, aqueous solution, acidic, pH $\sim$2.5, specific gravity 1.28.

The plating obtained from this solution is lustrous; crystallizes densely; has uniform color; and has good binding characteristics. Although its plating stress is larger than acidic nickel, the plated layers are thinner; but below 650°C the hardness can still be maintained at HB 455 to 500. Therefore it can be used as working plating for temperature conditions of 650°C.

14. Nickel "M" - I

Nickel "M" - I solution is a light green, translucent, aqueous solution, weakly acidic, pH $\sim$6.5, specific gravity 1.04.

This solution is stable; is noncorrosive; and binds strongly. Although it deposits slowly and the plating is thin, the crystallization is dense and the plated layer is grey black in color. It is mostly used for plating magnesium and magnesium alloys.

15. Nickel "M" - II

Nickel "M" - II solution is a light green, translucent, aqueous solution, weakly acidic, pH $\sim$8.8, specific gravity 1.04.

The performance and application of this solution are the same as for nickel "M" - I except that the color of the plating is grey white.

16. Nickel "M" - III

Nickel "M" - III solution is a light green, translucent, aqueous solution, weakly acidic, pH $\sim$6.4, specific gravity 1.04.

The plating obtained with this solution takes on a slight yellowish color apart from which it is the same as nickel "M" - II.

Conclusion

The Nickel series of electroplating solutions is one of the important ones in electroplating technology. There are many varieties and their performances and applications differ. The quantities used are large and they are applied broadly.

Consequently to understand precisely the characteristics and applications of each type nickel plating solution is an important link which must be mastered in electroplating technology. Presently there are more than a few varieties in the nickel series of electroplating solutions that have to date not received expanded application and still await further research and development.

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NATION CONCENTRATES ON DEVELOPING BIOTECHNOLOGY

OW071816 Beijing XINHUA in English 1454 GMT 7 Oct 86

[Text] Beijing, 7 October (XINHUA)--China will develop its biotechnology focusing on gene, cell, enzyme, and fermentation engineering in the coming 15 years and beyond, according to an expert from the Chinese Academy of Sciences.

China will also spare no effort to pursue newly arising aspects in biotechnology while transforming its traditional industry in this regard, the expert said.

Shen Yumin made the remarks at a briefing on the international exhibition and symposium on biotechnology and life sciences (Biotech China 1986), which is to be held next week.

Biotechnology is one of the major aspects of China's efforts to develop its high technology. Since last year, the State Council has invited more than 200 noted scientists and scholars to work out an overall plan with regard to the development of advanced technology.

On display at the exhibition, the first of its kind since the founding of new China in 1949, are most up-to-date scientific research findings and products from 70 companies and factories in this field in recent years. Also on display are products and equipment from 37 corporations and firms from the United States, the Federal Republic of Germany, Sweden, Great Britain, France, Switzerland, Australia, and Japan as well as Hong Kong.

Noted scholars and experts in biotechnology from China and other participating countries of the exhibition will exchange views on the current situation in China as well as worldwide in biotechnology development in 22 symposiums.

Specific negotiations will also be held during the exhibition between Chinese and foreign corporations on establishing joint ventures or cooperatively managed enterprises. About 10 foreign companies have expressed their willingness to establish such enterprises in China or to transfer technology to China, said Hu Lisheng, organizer of the exhibition.

Hu, who is also deputy general manager of the China Hua Yang Technology and Trade Corporation, said that many Chinese companies are also ready to transfer their biotechnology to other countries, as China, she noted, has taken the lead in some aspects.

The exhibition is jointly sponsored by the China Hua Yang Technology and Trade Corporation, the China International Trust and Investment Corporation (CITIC) and the China International Conference Promotion Center of Hong Kong.

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CSO: 4010/17

LASER USED TO 'WELD' HUMAN BLOOD VESSELS

OW071156 Beijing XINHUA in English 1128 GMT 7 Aug 86

[Text] Shanghai, 7 August (XINHUA)--Doctors in this city have successfully used laser beams to connect human blood vessels.

A patient named Zhou Lianchang, who received the operation on an artery in his left upper arm a month ago, recovered well, they said.

Doctors of the Zhongshan Hospital in Shanghai did the operation 25 June. They said the process is something like a worker welding a steel tube.

The artery, which was cut in an accident in February, was rejoined after 10 minutes and lbood circulation restored.

Zhang Liang, who invented the technology, explained that "the inner walls of the blood vessel dissolved and merged together under the heat of the laser beam."

Laser treatment is easier than suture, she said. The operators need only to judge the suitable laser intensity and control the time of illumination.

"If a suture operation is performed in cases like Zhou's, it takes 20 minutes," she said.

Since 1984, the technology has been tested in the laboratory on rats and dogs, as well as vessels taken from human bodies. Results have shown that the inner walls of the "welded" vessels are smooth.

At present, the 45-year-old assistant research fellow said, it can only be used on vessels with a diameter of at least 4 millimeters. She is studying how to use it on finer vessels.

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CSO: 4010/17

NOTED MISSILE EXPERT CHEN GUANGYU HONORED

Beijing GUANGMING RIBAO in Chinese 22 Sep 86 p 1

[By reporter Liu Jingzhi [0491 2417 2535] and correspondent Zhu Yuemin [2612 2867 3046]: "The S&T Commission Under the Ministry of Ordnance Industry Bestowed on Famous Ballistics Expert Chen Guangyu the Honorary Title 'Model Who Dedicated His Life to National Defense S&T'; For Over 30 Years, Chen Daringly Entered Forbidden Zones; Courageously Scaled the Heights of S&T, was an Expert and Wise Teacher, and had Dedicated His Life to the Testing Ground"]

[Text] On 20 September, the party committee of the S&T Commission under the Ministry of Ordnance Industry called an on-the-spot ceremonial meeting at a certain base in China's northeastern borderland to bestow on the late Comrade Chen Guangyu [7115 0342 1342] the honorable designation "Model Who Dedicated His Life to National Defense S&T." Chen had been senior engineer at the technological research institute at the base, vice president of the Ballistics Institute of the China Ordnance Society, and ballistics expert.

At a crossroad in his life, he courageously turned toward light. During the entire progress of his climb to the heights of S&T, it has been his conviction that the Chinese people must not lag behind anyone else, but should rather be courageous pathbreakers in uncharted forbidden zones.

On the eve of liberation, the CPC underground contacted Chen Guangyu in the mountain city of Chongqing, hoping to make him stay on and serve the new motherland that was coming into being. About the same time, special agents of the Kuomintang also contacted him, wanting him to leave and go to Taiwan.

Knowing well the calamity that the special agents could inflict if he disobeyed them, he, in his fervent love of the soil where he had grown up, still managed with great ingenuity to safely stay behind, even to preserve some important instruments, which he delivered into the hands of the people.

Early in the winter of 1953, Chen Guangyu valiantly gave up the conveniences of city life, and by ox cart dauntlessly moved into the boundless grasslands of the Hoqin plain, braving the icy winds north of the Great Wall. On this extremely bleak and desolate expanse, China's first testing range for conventional weapons was set up. The only shelter for Chen and his men were air defense bunkers shaped like grave mounds left behind by the Japanese

Kwantung Army. Deep at night, wolves and foxes could be heard howling, and wild animals ventured almost up to the doorsteps. It is under these trying conditions that Chen Guangyu, as responsible technical leader, led the other comrades in construction and simultaneous experiments, accomplishing the large-scale research and experimental task of developing the 85mm cannon and the 122mm howitzer.

One summer, the institute in charge of weapons testing grounds and weapons research decided to conduct both checking of range charts and testing of gun effectiveness in a hot and humid area of South China. Two plots, 30 km apart, had been selected in advance by men of the ordnance institute together with foreign experts. On a piece of land in between recently imported valuable rubber trees had been planted.

This would not do: would the rubber trees not be destroyed by falling shells? There was no time to look for another testing ground. For climatic reasons, any delay of the tests to later than 10 July would mean that all testing would have to be postponed to next year. What to do? After an intensive study of the situation, Chen Guangyu came up with an unprecedented testing plan: "Changing gun emplacements and fixing projectile impact area."

Finally, he avoided destruction of the rubber trees, by evolving a new testing theory and method in China.

Range charts are the eyes of artillerymen. All range charts compiled so far in other countries compute to only 3,000 meters above sea level. Many mountainous areas in China are from 3,000 to 6,000 meters above sea level, and what if the battlefield is a mountain areas that high? Chen Guangyu decided to fill the existing gap in computations.

Moving a gun up a 6,000-meter-high mountain is a task that would frighten anyone; the difficulty of accomplishing this scientific research project can well be imagined. However, S&T personnel under Chen's leadership braved severe cold and endured the many severe adversities of high mountain terrain, as they moved into the high plateaus of Qinghai and Gansu, where they conducted many gunnery tests. They produced a plan for a "target file," solved the difficulty of recoil, and for the first time obtained valuable gunnery data for the highest mountain regions in the world, which contributed to victory in the self-defense counterattack that was just at that time being launched. Later, Chen Guangyu after painstaking research compiled a "Aerial Burst Trajectory Chart" which reduced bombing error from 60 or 70 meters to only 2 or 3 meters.

Chen's outstanding contributions in the field of trajectory charts was honored by granting him the S & T achievement reward of the All-China Science Congress in 1978.

He was not only expert but also hardworking teacher. He stood for equality of all men in the face of science.

Because of the extreme shortage of high-quality specialized personnel in the early days of the weapons testing range, two groups of senior middle school

graduates from several provinces were recruited on different occasions, also several secondary technical grade students from the ordnance school. To train them as quickly as possible to become specialists as required at the weapons testing ground, a training class was instituted at the base, with Chen Guangyu compiling teaching material and personally giving instructions.

He often said: "We must not leave everything for the young people to explore all by themselves. We must teach them whatever we know, and whatever we don't know we must research together with them." He, therefore, always warmly received anyone who asked his advice. Many comrades, when writing articles, would request his help, corrections, and suggestions. In each case he would read through their writings very carefully and conscientiously check with regard to theoretical basis, formula deductions, and actual feasibility, and correct, or even rewrite the articles. However, when it came to signing the articles, he would never put his name on them, no matter how emphatically the party in question would ask him to do so. In 1981, when Chen was seriously ill, a technician asked him for advice in a problem the technician himself could not solve. With shaking hands, lying on his sickbed, Chen would carefully do his mathematical calculations and patiently discuss and explain things to this member of the technical staff, warmheartedly encouraging that person to pursue the problem as a significant piece of research.

During one discussion, he disagreed with one young technician, and the two argued one whole afternoon without one being able to persuade the other. That evening, Chen could not sleep because his brain kept working on the problem. After repeated comparative studies he found out that the proposition of the other party was actually right. He sought out the said technician the very next day and told him: "Your viewpoint was right; you should write an article about it, it is worth publicizing it throughout the country."

Chen was most loyal and devoted to his motherland and its people and endured unjust treatment. In his struggle under adverse circumstances, he dedicated his life to the wide Hoqin grasslands.

Chen Guangyu's conduct at the conventional weapons testing base was universally acclaimed as exemplary, but during the period of the historically unprecedented upheaval, he too was unable to escape the misfortune of being persecuted. His wife of many years--the two were very close to each other--was driven to insanity. His only daughter was sent to work in a mountain village miles away. In his "cowshed" days of exile, his body fell victim to diabetes and hepatitis...

However, after his return, he quietly brushed off dirt and bloodstains, roused himself, and threw himself into the all-out battle for his motherland's cause of defense S&T.

When still labelled "for controlled employment" by the intelligence office, he used his proficiency in English and German to compile and publish such materials as "List of Testing Methods on U.S. Weapons Testing Ranges," "List of Articles of the U.S. Ballistic Research Institute," "List of Reports of the Aberdeen Proving Ground of the U.S. Army," thereby initiating scientific and technological intelligence work at the base.

At the same time, he directed analyses of abnormal results of speed measurements on shell fragments and their casualty inflicting effectiveness, presented ideas on exposure to low-temperature, low-moisture indices, and, using television cameras, presented a demonstration of measurement of projectile impact indices.

In September 1979, this old intellectual of over 60 years of age finally became a member of the CPC, realizing the wish he had cherished for over 30 years.

To enhance theoretical research, and have the work at the weapons testing range attain advanced world standards, Chen Guangyu decided to reestablish the ballistic research institute, which had come to a premature end in the "Cultural Revolution." At this time, his health deteriorated, and he felt that he would have little time left. During preparatory work for the establishment of the research institute, Chen would often endure severe liver pains when he went on business trips in crowded busses.

When he made a business trip to Lintong in Shaanxi Province, his sister, who headed the department of internal medicine in a certain hospital, would rebuke him with tears in her eyes: "How can you still travel in such poor health?" He quietly replied: "I just became a party member; I must make strict demands on myself. I must make the best use of my time, must straighten out and express all life data in my brain." In March 1982, Chen Guangyu died of illness, ending a frustrated and tortuous path through life. Fulfilling his only request shortly before he died, his ashes were scattered over the weapons testing ground in the Hoqin plain where he had worked for almost 30 years.

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CSO: 4008/10

S&T ACTIVITIES AT VARIOUS CHINESE SCHOOLS

Beijing DIANZI KEXUE JISHU [ELECTRONICS SCIENCE AND TECHNOLOGY] in Chinese Vol 16, No 6, 10 Jun 86 pp 38-39, 42

[Article by Lü Lu [0712 6922]: "A Guide to Entrance Examinations Regarding Disciplines of Electronics and Research Directions for Master's Graduate Students"]

[Text] We have compiled incomplete statistics on the units with master's graduate students in various electronics disciplines and on their direction of research, which are described below. Please note: due to limited space, the complete name is used the first time a unit appears, together with a number. Thereafter, only the number is used.

Antenna electrophysics and antenna electronics: Fudan University [1], Sichuan University [2], Shanghai Normal University [3], Wuhan University [4], Beijing University [5], Jiangxi University [6], Nanjing University [7], Xibei Academy of Electronic Communications Engineering [8], Xibei University [9], Jilin University [10], Lanzhou University [11], Xiamen University [12], Shandong University [13], Nankai University [14], Zhongshan University [15], Huazhong Normal University [16], Huadong Normal University [17], Hangzhou University [18], Institue of Physics, Chinese Academy of Sciences [19], and Changchun Institute of Physics, Chinese Academy of Sciences [20].

Electromagnetic and microwave technologies: Chengdu Academy of Electronic Communications Engineering [21], Beijing Academy of Broadcasting [22], Beijing College of Industry [23], Second Research Institute, Ministry of Astronautics [24], Institute No 607, Ministry of Astronautics [25], Institute of Electronics, Chinese Academy of Sciences [26], Institute of Communications Measurement and Control, Chinese Academy of Sciences [27], PLA Academy of Communications Engineering [28], PLA Academy of Engineering Technology [29], Huadong Engineering Academy [30], Posts and Telecommunications Science Research Institute [31], Institute No 4, Ministry of Posts and Telecommunications [32], Zhejiang University [33], Xi'nan Institute of Electronics [34], Nanjing Electronics Engineering Research Center [35], Xi'nan College of Transportation [36], Beijing College of Posts and Telecommunications [37], Qinghua University [38], Shanghai College of Transportation [39], Chinese College of Science and Technology [40], Shanghai College of Science and Technology [41], Nanjing Engineering Institute [42],

Xibei College of Industry [43], Chinese Institute of Wave Propagation [44], Beijing Academy of Aeronautics [45], and [8].

Communication and electronic systems: National Defense College of Science and Technology [46], Guangzhou Institute of Electronics [103], Xinjiang Institute of Physics, Chinese Academy of Sciences [104], PLA Academy of Electronics [47], Dalian Engineering Academy [48], Fuzhou University [49], Hua'nan Engineering Institute [50], Guangzhou Institute of Communications [51], Jilin College of Industry [52], Sichuan Institute of Communications [53], Institute No 504, Ministry of Astronautics [106], 8th Department of Design, Shanghai Bureau of Astronautics [54], Institute No 802, Shanghai Bureau of Astronautics [55], Institute No 804, Shanghai Bureau of Astronautics [56], Institute No 25, Second Research Institute, Ministry of Astronautics [57], Institute No 8359, Third Research Institute, Ministry of Astronautics [58], Xi'an College of Communications [59], Institute No 3, Ministry of Posts and Telecommunications [60], Institute NO 10, Ministry of Posts and Telecommunications [61], Wuhan Institute of Posts and Telecommunications [62], Shanghai College of Industry [63], Nanjing Institute of Aeronautics [64], Tianjin University [65], Huazhong Institute of Engineering [67], Chinese Institute of Aeronautic Antennas and Electronics [68], Nanjing Institute of Posts and Telecommunications [69], Hohhot Engineering College [70], Hohhot Institute of Navigational Engineering [71], [21], [26], [8], [28], [29], [22], [35], [33], [34], [23], [25], [32], [42], [38], [39], [41], [30], [37], [45], and [31].

Signal circuits and systems: Beijing College of Engineering [72], Measurement Center, 2nd Research Institute, Ministry of Astronautics [74], Institute No 33, 3d Research Institute, Ministry of Astronautics [75], Hefei College of Industry [76], Dongbei Institute of Heavy-Duty Machinery [77], Hangzhou Academy of Electronics Industries [78], Wuhan Steel Institute [79], Air Force Radar Institute [80], Anhui University [81], Hebei Industrial Institute [82], Tongji University [83], Northern College of Communications [84], [47], [29], [21], [8], [24], [43], [37], [71], [40], [46], [42], [39], [30], [26], and [45].

Electronics materials and components: Xi'nan Institute of Applied Magnetics [85], [39], [21], [20], [67], and [34].

Electrophysics and components: Beijing Institute of Vacuum Electronics [87], Huabei Institute of Photoelectronics [88], Xi'nan Institute of Electronics Engineering [89], [21], [26], [33], [42], [59], [50], [8], [70], [46], and [38].

Electrophysics and particle beam physics: Xi'an Institute of Optics and Fine Mechanics, Chinese Academy of Sciences [90].

Vacuum physics: Lanzhou Physics Institute, China Institute of Space Technology [91], and [1].

Electrophysics and ion-beam physics: Yunnan University [94], [49], and [23].

Semiconductor physics and components: Nanjing Institute of Electronics Components [95], [1], [18], [72], [33], [39], [7], [31], [42], and [37].

Semiconductor physics and semiconductor component physics: Hebei Semiconductor Institute [96], Institue of Semiconductors, Chinese Academy of Sciences [98], Heilongjiang University [99], [2], [21], [50], [6], [104], [59], [65], [70], [8], [9], [14], [23], [10], [5], [82], [40], [15], [67], [12], [38], [94], [33], [39], [7], [18], and [95].

Solid physics: Hubei University [102], [4], [94], [38], [41], [11], [1], [40], [33], [10], [13], [65], [5], and [19].

Electron-ion physics: [14] and [5].

Electron accelerator physics: Yunnan Institute of Fluid Physics [105].

Industrial electronics technologies and electromagnetic measurements: Huadong Institute of Chemical Engineering [107], [39], and [33].

Biomedical electronics: [42].

Antenna technologies: Wuhan Institute of Surveying and Mapping [108].

Magnetics: [11] and [40].

Acoustics: [7], [40], [50], and [5].

Optics: Changchun Institute of Optics and Fine Mechanics, Chinese Academy of Sciences [109]: opto-electrical control technologies, computer applications, and optical instrumentation and electronics applications. Opto-electronics institutes, Chinese Academy of Sciences [110]: opto-electronic signal processing, opto-electronic control technology. [36]: optic fiber communications. [7]: Computer holography, optical information exchange and processing. [12]: opto-electronics, low-light spectroscopy.

Electro-optical instrumentation: Institute No 803, Shanghai Bureau of Aeronautics [111].

Spectroscopy and quantum electronics: Shandong Normal University [112].

Photoelectric technology: Institute No 8358, Ministry of Astronautics, Institute No 211, Ministry of Ordnance Industry [114], and [67].

Photoelectronics technology: Changchun Institute of Optics and Fine Mechanics [115], 014 Central Training Center, Ministry of Astronautics [116].

Test and measurement technologies and instrumentation: [21].

Computer organization and system structure: Huabei Institute of Computer Technology [117], Beijing Institute of Scientific Research [118], Institute of Computing Technology, Chinese Academy of Sciences [119], Shenyang Institute of Computing Technology, Chinese Academy of Sciences [120], Institute 706, Ministry of Astronautics [121], PLA Military Engineering Institute [122], Huadong Computer Institute [123], Jilin Engineering Institute [124], [39],

[7], [40], [67], [33], [1], [59], [50], [78], [8], [70], [4], [46], [38], [14], [65], [54], and [10].

Computer science and theory: Tongji College of Medicine [125], Chongqing University [126], [5], [112], [13], and [46].

Computer software: Software Institute, Chinese Academy of Sciences [127], Institute of Mathematics, Chinese Academy of Sciences [128], Computing Center, Chinese Academy of Sciences [129], Wuhan Institute of Mathematics Engineering, Institute of Navigation [130], Shanghai Computer Institute [97], Institute of Astronautical Science [100], Nei Monggol University [131], Shenyang College of Engineering [132], [1], [83], [9], [43], [40], [14], [50], [67], [5], [4], [7], [38], [45], [119], [120], [121], [74], [123], [39], [2], [59], [17], [10], [12], [28], [15], [21], [46], [99], [8], [118], [72], and [81].

Computer applications: Beijing Normal College [133], Dongbei Engineering Institute [134], Xi'an Academy of Highway Studies [135], Hunan University [136], Chinese People's University [137], Shanghai Institute of Ocean Shipping [138], Chengdu College of Science and Technology [93], Zhongnan College of Engineering [139], Liaoning University [140], Institute of Computer Systems Engineering, Ministry of Electronics [141], Institute No 103, 1st Research Institute, Ministry of Astronautics [142], Computer Center, 3d Research Institute, Ministry of Astronautics [143], Computer Center, Ministry of Astronautics [144], Institute No 14, 1st Research Institute, Ministry of Astronautics [145], Institute No 631, Ministry of Astronautics [146], Institute No 17, 2nd Research Institute, Ministry of Astronautics [147], Chengdu Institute of Computer Applications, Chinese Academy of Sciences [148], Chinese Institute of Aeronautic Antenna Electronics [149], Beijing Institute of Controls Engineering, Academy of Space Technology Research [150], Institute No 508, Academy of Space Technology Research [151], Beijing Institute of Information Controls [152], Beijing Automation Institute, Ministry of Machine Building [153], Ministry of Railways Science Academy [154], Institute of Hydroelectric Sciences, Ministry of Water Resources and Electric Power [155], Beijing General Academy of Non-Ferrous Metals Research [156], Wuhan Academy of Water Transport Engineering [157], Beijing Department of Graduate Students, Shaanxi Institute of Mechanics [158], Dalian Institute of Ocean Shipping [159], Air Force Engineering Academy [160], Zhejiang Institute of Silk Engineering [161], Zhengzhou University [162], Beijing Economics Institute [163], Shenyang Industrial Institute [164], Xi'an Metallurgy Institute [165], Shanghai Railways Institute [166], [77], [21], [64], [28], [29], [71], [63], [37], [23], [72], [39], [132], [30], [45], [83], [70], [82], [107], [42], [18], [117], [121], [75], [24], [103], [104], [119], [118], [33], [14], [41], [38], [76], [7], [97], [1], [40], [84], and [108].

Automatic control theory and applications: Institute of Atmospheric Dynamics, Ministry of Astronautics [167], 2nd Artillery Academy, Navy [168], Shenyang Institute of Automation, Chinese Academy of Sciences [169], Jiangxi Industrial College [170], Henan University [171], [72], [23], [58], [59], [42], [153], [70], [21], [48], [134], [40], [50], and [46].

Industrial automation: Chinese Textile College [172], Tianjin Institute of Light Industry [173], Kunming Engineering Institute [174], [63], [65], and [67].

Automation instruments and devices: [38].

Navigation electrics engineering: Naval Engineering Institute [175].

Pattern recognition and intelligence control: [39], [67], [45], and [38].

Electric power systems and their automation: Zhengzhou Engineering Institute [176], Wuhan Institute of Water Conservancy and Electric Power [177], [93], [136], and [67].

Power generating plant engineering: [67].

High voltage engineering: [177].

Thermal control systems: Institute 613, Ministry of Aeronautics [178].

Technology economics: Graduate Studies Institute, Chinese Academy of Social Sciences [179]: applications for computers technology economics.

Information sciences: [73].

Systems engineering: [38], [59], and [46].

Theoretical electrical engineering: [126], [70], [65], and [67].

Applied mathematics: [8], [43], and [50].

Computer mathematics: [48], [94], and [178].

Basic mathematics: [14].

Welding: Institute of Metallurgy, Chinese Academy of Sciences [180]: applications of computers in welding.

Casting: Nei Monggol Engineering Institute [181]: computer-aided analysis of the cast-plug solidification process.

Engineering mechanics: [157]: computer-aided mechanical design, CAD, and computer specialty systems for mechanical designs.

Mechanical manufacturing: Wuhan Engineering Institute [182], [126], [93], [109], [36], [43], [8], [49], [21], [50], [40], [67], [65], [78], [109], and [136].

Mechanics: [33]: computer graphics and their applications in engineering.

Light industrial mechanics: [173]: computer analysis.

Electro-mechanics: [42].

Precision electro-mechanics: [67].

Agricultural machinery design and manufacturing: Luoyang Engineering Institute [66]: microcomputer applications technology for externally fitted measurements of agricultural machinery.

Precision machinery instrumentation: [126].

The following are some specialties and institutions holding graduate classes.

Computer software: Huanghe University [183], [7], [10], [46], and [45].

Computer applications: Guizhou Engineering Institute [184], Chinese Industrial College [185], [30], [36], [43], [64], [134], [70], [76], and [29].

Communications and electronics systems: Beijing Department of Graduate Students, Huadong Petroleum Academy [186], [69], [168], [29], and [67].

Electromagnetics and microwave technologies: [21] and [36].

Turbine management and engineering (computer drafting): [159].

Electrophysics and devices: [21].

Nuclear electronics and nuclear detection technology: Chinese Academy of Atomic Energy Sciences [187].

Theoretical electrical engineering: [126].

Systems engineering: [46].

Digital communications and fiber optic communications: [62].

Computer organization and systems structure, computer devices and equipment, pattern recognition and intelligence control, electronic materials and components, semiconductor physics and devices, and precision electronics machinery: [67].

Software technology fundamentals: [45].

Computer science and technology: [59].

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COMPOUND MOMENT METHOD OF ESTIMATING PARAMETERS IN COMPOUND EXTREME DISTRIBUTION; APPLICATION TO ENGINEERING DESIGN

Qingdao SHANDONG HAIYANG XUEYUAN XUEBAO [JOURNAL OF SHANDONG COLLEGE OF OCEANOLOGY] in Chinese Vol 16, No 3, 30 Sep 86 pp 98-106

[English abstract of article by Zhao Weiqian [6392 4850 6197], Zhang Dacuo [1728 1129 6934] of Shandong College of Oceanology, Li Huiquan [2621 6540 2938] of Guangdong Fisheries Institute, and Qu Baozhong [2575 1405 1813] of PLA 38611; paper received 17 January 1985]

[Text] The parameters in Poisson-Gumbel compound extreme distribution are estimated from common methods and compared. The results show that among them the moment method is better. This method, however, is not very perfect, an improved method, the compound moment approach is presented. Actual examples indicate that the presented approach is better than those mentioned above.

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/6091
CSO: 4009/1038

SYNTHESIS AND THE CRYSTAL STRUCTURE OF $La_6NiSi_2S_{14}$ AND $La_6CoSi_2S_{14}$

Liaoning YINGYONG HUAXUE [CHINESE JOURNAL OF APPLIED CHEMISTRY] in Chinese Vol 2, No 4, Dec 85 pp 42-46

[English abstract of article by Jin Zhongsheng [6855 6988 5116], Li Zhuotang [2621 0587 2788], and Du Youru [2629 2589 1172] of the Changchun Institute of Applied Chemistry, CAS]

[Text] Single crystals of $La_6NiSi_2S_{14}$ and $La_6CoSi_2S_{14}$ were obtained by flux growth method at 1100°C. They belong to the hexagonal system, $P6_3$, $a = 10.293(1)[10.290(2)]$; $c = 5.774(1)$ [5.763(2)]Å, A = 1 and R = 0.036[0.0959] for 627[629] reflections ($I \geq 2.5\sigma(I)$). La is 8-coordinated in a distorted dicapped triangular prism with an average La-S distance 2.990[2.992]Å. Ni[Co] (B site) is in a trigonal antiprism of 6S (three Ni[Co]-S have distance of 2.559[2.529]Å and the other three have distance of 2.650[2.679])Å with 1/6 occupancy. Si (C site) is in a tetrahedron and coordinated with S_2 at distance of 2.130[2.146]Å and coordinated with S_3 at 2.098[2.093]Å.

(Paper received 21 Sep 84, finalized 24 Apr 85.)

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CSO: 4009/1033

DETERMINATION OF THE CRYSTALLINITY AND CRYSTAL SIZE OF DIFFERENT TYPE POLYSTYRENE (PST)-POLYOXYETHYLENE (PEO) BLOCK COPOLYMERS BY X-RAY DIFFRACTION METHOD

Liaoning YINGYONG HUAXUE [CHINESE JOURNAL OF APPLIED CHEMISTRY] in Chinese Vol 2, No 4, Dec 85 pp 76-78

[English abstract of article by Li Xiaoding [2621 1420 1353], Li Yaohui [2621 5069 2585], and Shi Liezhong [4258 0441 0022] of the Hubei Research Institute of Chemistry]

[Text] The crystallinity and crystal size of different type polystyrene (PST)-polyoxyethylene (PEO) block copolymers and the same type block copolymers with different PEO contents have been determined by X-ray diffraction method. It was found that the crystallinity and crystal size increase with the increase of the PEO content and decrease in the order: BAB>AB>ABA. (Paper received 24 Oct 84, finalized 26 Mar 86.)

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